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1947 COATINGS CHART

TYPE OF PLASTIC BASE	OUTSTANDING CHARACTERISTICS (a)	TYPICAL USES ON COMMERCIAL PRODUCTS: Paper	Metal	Fabric	Wood	Maintenance Finishes	Shelf Goods	REMARKS ON USES	SOLVENTS	APPLICATION PROBLEMS (b)	DRYING FUNCTION OF	FUTURE DEVELOPMENTS (c)	TRADE NAMES	MANUFACTURERS
Acrylate and methacrylate resins	Extreme clarity Light resistance Flexibility Available as dispersions in water	—	—	Starchless collars Textile finishing	—	—	—	—	Ketones Esters Chlorinated hydrocarbons Hydrocarbons for some grades	Tendency to "pick-up" when brushed or "cob-web" when sprayed	Air- or force-dry to remove solvents	Lessen tendency toward "pinholing"	Acryloid (41), Acrysol (41)	41
Alkyd resins (phthalic anhydride-glycerol-oil combinations)	Versatility of formulation Durability Relatively low cost	—	Automobiles Trucks Farm equipment	Proofed fabrics	—	—	Miscellaneous home use Water-resistant "water" paints	—	Hydrocarbons	—	Solvent removal and chemical hardening	Greater flexibility	Alkydol (1), Alkymol (52), Amberlac (41), Aquaplex (41), Arochem (50), Aroplaz (50), Bakelite (7), Beckosol (40), Carbasol (36), Duraplex (41), Dyal (45), Falkyd (19), FCD (21), Mirasol (36), Paraplex (41), Petrex (25), Rezyl (5), Syntex (29), Teglac (5)	1, 5, 7, 8, 19, 21, 25, 29, 36, 40, 41, 45, 50, 52
Allyl resins	Extreme hardness Clarity	—	—	—	—	—	—	—	—	—	—	Now in development stage	—	23, 31, 39, 44
Asphalts	Water resistance Chemical resistance Easily applied molten Low cost	Roofing Packaging	Sound-deadening of auto bodies	—	—	Pipe coatings Roofing	—	—	Applied molten Water emulsions Hydrocarbons	—	To remove solvents unless applied molten	Increase flexibility Oxidation resistance	—	2, 28, 53
Cellulose acetate	Clarity Flexibility Oil resistance Light resistance	Decorative overfinishes Oil- and grease-resistant papers	—	Starchless collars	—	—	—	—	Ketones Chlorinated hydrocarbons	Tendency to "pick-up" when brushed or "cob-web" when sprayed	To remove solvents	Improve solubility and water resistance	—	4, 9, 15, 25, 32, 48
Cellulose, carboxymethyl	Water-soluble	—	—	—	—	—	—	—	—	—	To remove water	Relatively recent development	CMC(25)	25
Cellulose mixed esters (acetate butyrate, acetate propionate)	Similar to the acetate Better solubility	*SIMILAR TO CELLULOSE ACETATE*											—	25, 48
Cellulose, ethyl	Tough Flexible over wide temperature range Chemical resistance Increases toughness of lacquers	Cheese and miscellaneous food wrappings	Temporary coating for parts	Masking agent for preferential textile shrinkage	—	—	—	Wide range of compatibility permits use as general pigment dispersing medium	Alcohols Esters Aromatic hydrocarbons Hot melts with paraffin	—	Dry to remove solvents Cool hot melts to harden	Increase oil resistance	Ethocel (13)	9, 13, 25
Cellulose, hydroxyethyl	Applied from alkaline or neutral aqueous solution Clarity Toughness	—	—	Color binding agent	—	—	—	—	Water—alkaline or neutral depending on type	—	To remove water, after neutralization of alkali-soluble type	Relatively recent development	—	7
Cellulose nitrate	Relatively high softening temperature Readily soluble Relatively low cost	Miscellaneous decorative contings Moisture-proofing for regenerated cellulose film	Miscellaneous equipment	Artificial leather	Furniture	—	Home brushing lacquers Nail polish	—	Esters Ketones Alcohol for some grades	—	Dry to remove solvents	Decrease flammability	—	9, 16, 25, 32, 48
Chlorinated naphthalenes	Good electrical properties Nonflammable Chemical resistance	—	—	Impregnation of electrical insulation tapes	—	As extenders or plasticizers in corrosion-resistant tank linings	—	—	Wide variety applied molten or in same solvent as coatings base in which it is blended	—	Dry to remove solvents	Decrease tendency to cause skin irritations	—	26
Chlorinated paraffins	Nonflammable Miscible with many materials Low cost	—	—	Flameproofing awnings and tarpaulins	—	—	—	Used primarily as an extender or softening agent	Wide variety	Also applied molten	Dry to remove solvents or cool to harden	Improve heat stability	Chlorafin (25), Chlorparaffin (26), Chlorowax (11)	11, 25, 26
Chlorinated rubber	Chemical resistance Soluble in low-cost solvents Miscible with drying oils	Inks Soap wrap coatings	Air-conditioning equipment	—	—	Where chemical resistance desired	—	—	Ketones Aromatic hydrocarbons	—	Dry to remove solvents and produce chemical hardening of oils and resins present	Improve color Increase oxidation and oil resistance	Parlon (25)	25
Coumarone resins	Low-cost extenders for wax and resin compounds Inertness	Moisture, vapor proofing	Structural finishes	With chlorinated rubber for waterproofing	—	Anti-corrosive finishes Marine finishes	Aluminum bronze paints	—	Soluble in most solvents other than alcohols	—	To remove solvents	—	Cumar (3), Nevillac (34), Nevindene (34), Nuba (34), Paradene (34), Piccoumaron (37), Piccovar (37)	3, 34, 37
Cyclized rubber	Chemical resistance Miscible with waxes	Moisture-proof packaging papers	—	—	—	Where chemical resistance desired	—	—	Aromatic and aliphatic hydrocarbons	—	Dry to remove solvents	Increase oxidation resistance	Pliolite (24)	24
"Ester-type" resins—oil reactive (bicycloheptane dicarboxylic acid, and related esters in combination with drying oils)	General properties of phthalic anhydride resins Improved flexibility retention Improved heat resistance Produce water-resistant emulsion coatings	Durable paper for packaging	—	Electrical insulation	—	—	—	Reactivity of resin permits use with wide range of oils	Water (in case of emulsions) Hydrocarbons	—	Remove solvents or water and effect chemical reaction	Relatively recent development	C-9 (7)	7
Ethylene resins (polyethylene)	Electrical properties Inertness Toughness Flexibility over wide temperature range Heat resistance	—	—	—	—	—	—	—	Hydrocarbons and chlorinated hydrocarbons at elevated temperatures	Insolubility Can be "hot sprayed"	—	Improve solubility	—	7, 16
Isobutylene resins	Increase toughness of waxes Moisture resistance	*SEE WAXES, MICRO-CRYSTALLINE*										Decrease tendency toward tackiness upon aging	Vistanex (46)	46
Maleic resins	Light color and color retention Fast dry Relatively low cost	Printing inks Label coatings Lacquers	Tin lithographing	Oil cloth	Varnishes and enamels for interior use; wood rubbing lacquers and sealers	Where light color and medium durability are required	Interior varnishes and enamels of all types	Normally dispersed in drying oils using varnish technique	Hydrocarbons	—	Varnishes dry by oxidation in presence of metallic driers	Higher viscosity, faster dry	Amberol (41), Arochem (50), Beckacite (40), FCD (21), Krumbhaar (30), Lewisol (25), Synaryl (1)	1, 8, 21, 25, 29, 30, 40, 41, 50
Melamine resins	General properties of urea-formaldehyde resins Improved drying speed Improved water resistance Improved flexibility	High wet strength papers	Refrigerators	Textile and leather finishing	—	*SIMILAR TO UREA-FORMALDEHYDE RESINS*							Melmac (5), Resimene (32), Uformite (41)	5, 32, 41
Oleo-resinous materials (combinations of oils, and miscellaneous natural and synthetic resins)	Versatility of formulation, application and drying schedules Relatively low cost	Label coatings Cap liners	Tin lithographing	Oil cloth "Oil-silk" type of coatings	Varnishes	Where extreme chemical resistance is unnecessary	House paints	—	Hydrocarbons Turpentine	—	To remove relatively small amount of solvent Chemical hardening	Flexibility Exposure resistance	—	1, 5, 6, 8, 21, 25, 27, 32, 33, 35, 36, 40, 41, 47, 50
Phenol-formaldehyde modified and drying oil combinations (including para-phenylphenol-formaldehyde resins)	Versatility of formulation Durability Heat resistance Dispersion types are extremely fast drying	Electrical insulation	Can and drum linings	Electrical insulation Varnished cambric	Spar varnishes	General locks, boats, etc.	Varnishes	Para-phenylphenol-formaldehyde resins offer faster drying	Aromatic hydrocarbons Alcohols Esters	—	Remove solvents Chemical hardening	Color Flexibility	Amberol (41), Arochem (50), Bakelite (7), Beckacite (40), Beckopol (40), Dyphenite (45), FCE (21), Krumbhaar (30), Phenac (5), Synaryl (1)	1, 5, 7, 8, 21, 30, 40, 41, 45, 50
Phenol-formaldehyde pure resins (spirit-soluble, "heat-reactive" types)	Heat resistance Chemical resistance	—	Tank car linings Food cans Beverage cans	—	—	Linings for chemical processing equipment Food driers	—	—	Alcohols	—	Relatively high baking temperature or increased time of drying needed to thoroughly harden	Flexibility	Amberol (41), Arofene (50), Bakelite (7), Durez (17), Durite (18), Dyphene (45), FCD (21), Krumbhaar (30), Phenac (5), Super Beckacite (40), Varcum (51)	5, 7, 17, 18, 21, 30, 40, 41, 45, 50, 51
Rubbers, synthetic 1. Chloroprene 2. Butadiene-styrene 3. Butadiene-acrylonitrile 4. Polysulfide	Flexibility Toughness Water resistance Chemical resistance	Impregnation of inner soles High tear-strength paper	Linings	Rainwear Upholstery	—	—	—	—	Hydrocarbons Nitroparaffins Water dispersions	—	Solvent and water removal Chemical hardening	Oxidation resistance Decreased odor (4)	Ameripol (23), Butaprene (20), Butyl (46), Chemigum (24), Hycar (23), Perbunan (46), Thiokol (49)	16, 20, 23, 24, 46, 49
Shellac, spirit-soluble resins ("spirit" varnishes)	Soluble in alcohol Relatively low cost Ease of formulation	Label coatings Electrical insulation	Electrical insulation	—	Furniture Floors	—	Home use Floors Furniture	—	Alcohols	Different solvents required for various applications	To remove solvent	Water resistance Retention of flexibility	—	10, 12, 42, 54
Silicones	Resistance to high temperatures Hardness	—	Electrical insulation	Glass fiber electrical insulation tape	—	—	—	—	—	—	—	Relatively recent development	—	14, 22
Styrene resin (polystyrene)	Good electrical properties Soluble in hydrocarbons	—	—	—	—	—	—	—	Hydrocarbons Water dispersions	—	To remove solvents	Improve flexibility Improve adhesion	Bakelite (7), Piccolastic (37)	7, 37
Urea-formaldehyde resins and oil-resin combinations	Hardness Clarity Retention of whiteness upon baking and aging	Cap liners	Refrigerators Kitchen and hospital equipment	Textile finishing	—	—	—	—	Alcohols Alcohol-ethers	—	Remove solvents and effect polymerization	Along lines typified by melamine resin development	Beckamine (40), Beetle (5), Uformite (41)	5, 40, 41
Vinyl acetate resins	Clarity Soluble in many solvents Available in water dispersions	Bronze inks	—	Primarily for adhesive properties	—	—	—	—	Practically all types except aliphatic hydrocarbons	"Cob-webs" when sprayed	Remove solvents	Improve water-resistance Tendency to adhere to surface under pressure at normal or slightly elevated temperature	Elvacet (15), Gelva (43), Vinylite (7)	7, 15, 43
Vinyl alcohol	Water solubility Toughness Oil-resistant	Coating to improve printing	—	—	—	—	—	—	Water	—	—	—	Elvanol (16),	16
Vinyl butyral resins	Flexibility Reactivity which permits hardening similar to rubber	—	—	—	Furniture Adhesives	—	—	Coatings use relatively recent Sheetings used for safety glass laminating	Alcohols Esters	—	Remove solvents and harden	Improve reactants	Butacite (15), Butvar (43), Vinylite (7)	7, 15, 34
Vinyl chloride resins	Toughness Chemical inertness Not affected by many foods, oils, chemicals Has no effect on food, oils, chemicals	Food packaging	—	Shower curtains Garment bags Table cloths Rainwear Upholstery	Laboratory equipment	Lining plating and pickling baths Storage tanks Concrete vats and piping	—	—	Low boiling ketones at elevated temperatures Mesityl oxide Cyclohexanone Isophorone Water dispersions	Tendency to "pick-up" when brushed	To remove solvents To flux dispersions	Improve plasticizing agents	Geon (23), Vinylite (7)	7, 23
Vinyl chloride-acetate resins (higher chloride types)	Similar to vinyl chloride resins Somewhat increased solubility Greater flexibility for comparable viscosities	Food packaging	Strippable packaging	Shower curtains Garment bags Table cloths Rainwear Upholstery	Laboratory equipment	Lining plating and pickling baths Storage tanks	—	—	Low boiling ketones at elevated temperatures Mesityl oxide Cyclohexanone Isophorone Hydrocarbon dispersions	Tendency to "pick-up" when brushed	To remove solvents To flux dispersions	Improve plasticizing agents	Vinylite (7)	7
Vinyl chloride-acetate resins (lower viscosity types)	Similar to higher chloride types Improved solubility facilitating application Slight decrease in toughness and chemical resistance	Cap liners Drug packages	Sheet metal to be subsequently fabricated Foil	Thermoplastic mending fabric Coated cloth for package linings	—	Lining pickling and plating baths	—	—	Esters Ketones	Tendency to "pick-up" when brushed	To remove solvents Bake all but one type to promote adhesion on smooth surfaces	Improve temperature resistance Increase adhesion at lower baking temperatures for most types	Vinylite (7)	7
Vinyl chloride-vinylidene chloride copolymers	Chemical resistance Resistance to moisture vapor transmission	Food packaging	Strippable packaging	—	—	—	—	—	Ketones Water dispersions	—	To remove solvents or water	Improve solubility	Geon (23)	23
Vinyl formal resins	Toughness when reacted with appropriate aldehydes or resins	—	Wire enamels	—	—	—	—	—	Alcohols	—	To harden thermosetting mixtures	Improve solubility Improve water resistance	Formvar (43)	43
Vinylidene chloride resins	Chemical resistance Toughness Higher softening range than related thermoplastics	—	—	—	—	—	—	—	Cyclohexanone	"Pick-up" when brush recoated	To remove solvents	Improve solubility	Saran (13)	13
Waxes, paraffin ("crystalline")	Water resistance Easily applied molten without use of solvents Low cost	Coatings for bread and cheese wrappings, etc.	—	—	—	—	—	—	Applied molten or in water emulsions	Chilling prevents ready brushing of molten mixtures	Cool to harden	Decrease tendency to crystallize Improve film strength	—	2, 38, 46
Waxes, paraffin (amorphous, micro-crystalline)	Similar to "crystalline" types Improved film-forming properties	Cheese wrappers Laminated paper Food packages	Beverage containers Collapsible tubes	—	—	—	—	—	Applied molten	Chilling prevents ready brushing of molten mixtures	Cool to harden	Improve low temperature flexibility	—	2, 38, 53

1. Alkydol Laboratories, Inc., 3242 S. 50th Ave., Cicero 20, Ill.
2. Allied Asphalt and Mineral Corp., 217 Broadway, New York 7, N. Y.
3. Allied Chemical & Dye Corp., Barrett Div., 40 Rector St., New York 6, N. Y.
4. American-British Chemical Supplies, Inc., 180 Madison Ave., New York 16, N. Y.
5. American Cyanamid & Chemical Corp., 30 Rockefeller Plaza, New York 20, N. Y.
6. American Resinous Chemicals Co., Peabody, Mass.
7. Bakelite Corp., 30 E. 42nd St., New York 17 N Y.
8. California Flaxseed Products Co., 3135 E. 26th St., Los Angeles 23, Calif.
9. Celanese Corp. of America, 130 Madison Ave., New York 16, N. Y.
10. Colony Import and Export Co., 11 E. 44th St., New York 17, N. Y.
11. Diamond Alkali Co., Pure Calcium Products Div., P. O. Box 407, Painesville, Ohio
12. Wm. Diehl and Co., 334 W. 42nd St., New York, N. Y.
13. Dow Chemical Co., Midland, Mich.
14. Dow Corning Corp., Midland, Mich.
15. E. I. du Pont de Nemours & Co., Inc., Acetate Div., 350 5th Ave., New York, N. Y.
16. E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del.
17. Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y.
18. Durite Plastics, Inc., 5000 Summerdale Ave., Philadelphia 24, Pa.
19. Falk & Co., P. O. Box 1075, Pittsburgh 30, Pa.
20. Firestone Tire and Rubber Co., Akron, Ohio
21. France, Campbell & Darling, Kenilworth, N. J.
22. General Electric Corp., Schenectady, N. Y.
23. B. F. Goodrich Chemical Co., 324 Rose Building, Cleveland 15, Ohio
24. Goodyear Tire & Rubber Co., Inc., Akron 16, Ohio
25. Hercules Powder Co., Delaware Trust Building, Wilmington 99, Del.
26. Hooker Electrochemical Co., Niagara Falls, N. Y.
27. O. G. Innes Corp., 82 Wall St., New York 5, N. Y.
28. Johns-Manville, 22 E. 40th St., New York 16, N. Y.
29. Jones-Dabney Co., 1431 S. 11th St., Louisville 10, Ky.
30. Krumbhaar Chemicals, Inc., 24-30 Jacobus Ave., South Kearny, N. J.
31. Marco Chemicals, Inc., Sewaren, N. J.
32. Monsanto Chemical Co., 1700 S. Second St., St. Louis 4, Mo.
33. Nelio Resin Processing Corp., Div. of the Glidden Co., Jacksonville, Fla.
34. Neville Co., Grand Ave., Neville Island, Pittsburgh 25, Pa.
35. Newport Industries, Inc., 230 Park Ave., New York 17, N. Y.
36. C. J. Osborn, 132 Nassau St., New York, N. Y.
37. Pennsylvania Industrial Chemical Corp., Clairton, Pa.
38. Petroleum Specialties, Inc., 400 Madison Ave., New York 17, N. Y.
39. Pittsburgh Plate Glass Co., Columbia Chemical Div., Grant Building, Pittsburgh 19, Pa.
40. Reichhold Chemicals, Inc., 601 Woodward Heights Blvd., Detroit 20, Mich.
41. Resinous Products & Chemical Co., 222 W. Washington Square, Philadelphia 5, Pa.
42. Schwab Bros. Corp., 104 Maiden Lane, New York 5, N. Y.
43. Shawinigan Products Corp., Empire State Building, New York, N. Y.
44. Shell Chemical Div., Shell Union Oil Corp., 100 Bush St., San Francisco, Calif.
45. Sherwin-Williams Co., 115th & Cottage Grove Ave., Chicago 28, Ill.
46. Standard Oil Co. of New Jersey, 30 Rockefeller Plaza, New York 20, N. Y.
47. Synvar Corp., 415 E. Front St., Wilmington 99, Del.
48. Tennessee Eastman Corp., Kingsport, Tenn.
49. Thiokol Corp., 780 N. Clinton Ave., Trenton 7, N. J.
50. U. S. Industrial Chemicals, Inc., 60 E. 42nd St., New York 17, N. Y.
51. Varcum Chemical Corp., Packard Road, Niagara Falls, N. Y.
52. G. A. Wharry & Co., Inc., 95 Broad St., New York 4, N. Y.
53. Witco Chemical Co., 295 Madison Ave., New York 17, N. Y.
54. Wm. Zinsser & Co., 516 W. 59th St., New York, N. Y.

(a) These may refer to formulation, application, performance or economic factors. (b) Exceptions to standard roll-, drip-, spray- or brush-coating procedures. (c) Research for still further improvements appears possible along lines indicated.

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ADHESIVES CHART—1947

The adhesives described on this chart are those formulated primarily with one type of plastic base. Many commercial adhesives are made up of complex mixtures of different resins in order to attain a combination of properties not found in a single type of base. The manufacturers of adhesives listed at the bottom of the chart should be consulted before making a choice of material.

General Type	Chemical Type	Material	Bonding Classification[a]	Solvents[b]	Resistance Rating[c]: Water	Solvents	Heat	Cold	Fungus	Outstanding Advantages	Disadvantages	Effectiveness[c] of Bond with: Wood	Metals	Rubber	Glass	Thermoplastics	Thermoset plastics	Leather	Paper	Textiles	Ceramics	Manufacturers[d]
Synthetic thermoplastic resin adhesives	Cellulose derivatives	Cellulose nitrate	SR, F	E, K	F	P	P	F	E	General utility	High flammability	M	P	M	M	E	P	E	E	E	M	2, 18, 28, 32, 33, 40, 43, 45, 49
		Cellulose acetate	SR, F	E, K	P	M	F	F	E	Solvent resistance	Poor weather resistance	M	P	M	P	E	P	G	E	G	F	2, 18, 28, 32, 40, 45
		Cellulose acetate butyrate	SR, F	E, K	F	M	F	F	E	Toughness, flexibility	Fair weather resistance	M	P	M	F	G	P	G	E	E	M	40, 45
		Ethyl cellulose	SR, F	E, K	P	P	M	G	E	Alkali resistance, flexibility, toughness	Fair weather resistance	M	P	M	P	M	P	M	E	M	P	2, 17, 28, 33, 40, 45, 49
		Methyl cellulose	SR, F	A, W	P	P	F	F	E	Water solubility	Very poor water resistance	M	P	F	P	P	P	M	E	M	P	17, 45
		Hydroxyethyl cellulose	SR, F	W	P	E	F	F	E	Water solubility, resistance to solvents	Very poor water resistance	M	F	F	P	P	P	M	E	M	M	7, 45
	Acrylic esters	Methyl methacrylate	SR, F	Cl, E, H	G	G	M	M	E	Solvent resistance	Brittle films	P	P	M	P	G	P	G	E	E	F	18, 33, 40, 41, 45
		Ethyl acrylate	SR, F	Cl, E, H	G	F	P	G	E	Retains permanent tack	Flows at moderate temperatures	M	F	M	G	G	F	G	E	G	M	2, 40, 41, 45
		Styrene resin	SR, F	H	E	M	M	F	E	Electrical properties	Brittle films	F	P	M	P	M	P	G	E	M	P	11, 17, 32, 33, 40, 41, 45
	Vinyl resins	Vinyl alcohol	SR, F	A, W	P	G	F	M	E	Water solubility	Poor water resistance	M	F	M	F	M	F	G	E	G	P	2, 18, 28, 33, 42, 44, 45
		Vinyl acetate	SR, F	E, K	F	M	M	M	E	Lack of taste or odor, of value in food packaging	Fair water resistance	G	G	G	M	E	G	E	E	E	G	2, 6, 7, 10, 14, 15, 18, 28, 29, 33, 40, 42, 43, 44, 45, 49
		Vinyl chloride	SR, F	E, W	G	M	F	M	E	Lack of taste or odor, of value in food packaging	Fair heat resistance	M	G	G	G	E	G	E	E	E	G	2, 6, 7, 28, 33, 45
		Vinylidene chloride	SR, F	E, K	E	G	F	G	E	Toughness, cold resistance	Fair heat resistance	M	G	M	G	G	G	E	E	E	G	2, 17, 29, 45
		Vinyl chloride-acetate copolymer	SR, F	E, K	E	G	G	G	E	Resistance to solvents, etc.		F	F	F	F	F	F	F	F	F	F	2, 6, 7, 15, 33, 40, 45
		Vinyl acetal	SR, F	A, E	G	M	F	G	E	Excellent for glass		G	E	E	E	G	E	E	E	E	G	2, 6, 7, 15, 18, 32, 40, 42
		Alkyd resins	SR, F	E	G	M	P	M	E	Toughness, versatility	Limited use with heat and solvents	G	M	G	G	G	G	E	E	E	M	22, 23, 41, 45
		Coumarone-indene	SR	Cl, E, H, K	E	P	P	M	E	Resistance to water & alkali	Poor solvent resistance	M	G	G	G	G	M	G	G	G	F	2, 8, 35, 37, 45
		Modified waxes	F	H	E	P	P	G	E	Fast setting	Poor heat resistance	M	P	P	P	E	P	G	E	E	P	14
Synthetic thermosetting resin adhesives		Phenol-formaldehyde	R	A, K, W	G	E	G	G	E	Ease of application	Acid catalyst corrodes wood	M	P	E	P	P	G	M	M	M	G	7, 10, 11, 15, 19, 20, 26, 31, 38, 41, 45
			M	A, K, W	E	E	E	E	E	Only moderate heat required	Requires heat, special equipment	E	P	E	P	P	G	G	G	G	G	7, 10, 11, 15, 19, 20, 22, 26, 31, 38, 41, 45
			H	A, K, W	E	E	E	E	E	Excellent bond strength	Requires high heat, special equipment	E	P	E	P	P	G	E	E	E	G	2, 7, 10, 11, 15, 19, 20, 24, 25, 26, 31, 32, 38, 39, 41, 45
	Resorcinol resins	Resorcinol-formaldehyde	R	A, W	E	E	E	E	E	No heat nor acid required	Relatively high cost	E	P	E	P	G	G	E	E	E	G	1, 2, 7, 10, 19, 20, 26, 36, 38, 41
			M	A, W	E	E	E	E	E	Moderate heat, no acid required	Relatively high cost	E	P	E	P	G	G	E	E	E	G	1, 2, 7, 10, 19, 20, 26, 32, 36, 38, 41
		Resorcinol-phenol-formaldehyde	R	A, K, W	E	E	E	E	E	Ease of application, moderate cost	—	E	P	E	P	G	G	E	E	E	G	1, 2, 7, 10, 19, 20, 36, 38
			M	A, K, W								E	P	E	P	G	G	E	E	E	G	1, 2, 7, 10, 19, 20, 36, 38
		Resorcinol-furfural	R	A, W	E	E	E	E	E	Ease of application, excellent bond strength, neutral bonds	Relatively high cost	E	P	E	P	F	M	G	E	E	F	20
	Furan resins	Furfuryl alcohol	R	A	E	E	E	E	E	Excellent for cured resins	Acid catalyst corrodes wood	G	P	F	M	G	E	M	M	M	E	21, 47
			H	A	E	E	E	E	E	Good adhesion, inert	Requires heat	E	P	F	M	G	E	G	M	E	E	21, 47
	Amido resins	Urea-formaldehyde	R	W	M	E	M	E	E	Ease of application, non-staining	Decomposes in presence of excessively acid catalysts	E	P	P	P	P	P	G	E	F	P	1, 2, 7, 10, 15, 26, 31, 33, 38, 39, 41, 43, 45
			H	W	G	E	M	E	E	Non-staining	Weather resistance limited	E	P	P	P	P	P	G	E	G	P	1, 2, 7, 10, 15, 20, 26, 31, 33, 38, 41, 45
		Urea-furfural-formaldehyde	R	W	G	E	M	E	E	Craze resistant low pressure bonding	Weather resistance limited	E	P	P	P	P	M	G	E	E	P	1
		Melamine-formaldehyde	H	A, W	E	E	E	E	E	Colorless, water resisting	Requires heat	E	P	P	P	P	M	G	E	E	F	1, 2, 26, 32, 36, 41
	Polyester resins	Polyester elastomer	H	None or E, K	G	E	M	M	E	Quick, cold-setting initial bond, high strength attained by baking	Moderate heat resistance	M	E	P	E	M	F	M	E	E	M	27, 32, 41
		Unsaturated polyester	H	None	G	E	M	M	E	Clarity, somewhat thermoplastic	Moderate heat resistance	G	P	M	G	G	P	E	E	E	P	1, 7, 12, 27, 32, 39
	Mixed types	Phenolic-elastomer	H	Cl, K	E	E	M	G	E	Excellent for metals	Moderate heat resistance	G	E	E	E	P	G	E	E	E	G	2, 6, 7, 13, 15, 20, 32, 41, 47
		Urea-resorcinol	M	W	G	E	G	G	E	Better water resistance than UF	Requires heat	G	P	C	P	P	M	E	E	E	M	2, 38, 39, 41
		Urea-melamine	M	W	E	E	E	E	E	Better water resistance than UF	Requires heat	E	P	E	P	P	G	E	E	E	M	1, 2, 26, 38, 41
			H	W	E	E	E	E	E	Better water resistance than UF	Requires high heat	E	P	E	P	P	G	E	E	E	M	1, 2, 22, 26, 38, 39, 41
Rubber-base adhesives		Natural rubber	SR	Cl, H, W	M	F	F	M	E	Ease of application	Poor stability	F	M	G	G	G	G	M	G	G	F	2, 6, 10, 14, 15, 16, 23, 29, 30, 33, 34, 43, 45, 47
			V	Cl, H	G	M	M	G	E	Good adhesion to metals	Requires heat, metals brass plated	M	G	E	E	M	G	M	E	E	M	2, 6, 14, 15, 16, 23, 29, 33, 34, 43, 47
		Reclaimed rubber	SR	Cl, H, W	F	F	F	M	E	General household utility	Poor stability	F	F	G	P	M	P	M	G	G	M	2, 6, 10, 15, 16, 23, 28, 29, 30, 34, 43, 44, 45, 46, 47
			V	Cl, H	M	F	G	G	E	Good adhesion to metals	Requires heat, applications limited	M	M	G	M	P	P	M	G	G	M	2, 6, 15, 16, 23, 29, 34, 43, 44, 45, 46, 47
		Neoprene rubber	V	Cl, E, H, K	G	M	G	M	E	Good adhesion to metals	Requires heat	G	G	G	M	M	M	G	G	G	F	2, 6, 14, 23, 29, 33, 34, 43, 44, 45, 46, 47
			R	Cl, E, H, K	G	M	G	M	E	Good adhesion to metals	Fair solvent resistance	G	G	G	F	F	M	G	G	G	F	2, 6, 10, 14, 23, 28, 29, 33, 34, 43, 44, 45, 46, 47
		Butyl rubber	V	H	G	F	G	M	G	General utility, excellent aging	Requires heat	F	M	M	M	F	M	G	E	E	F	29, 34, 45, 46
			R	H	G	F	G	M	G	General utility, excellent aging	Fair solvent resistance	F	M	G	M	F	M	G	E	E	M	29, 34, 45, 46
		Butadiene-acrylonitrile rubber	V	Cl, H, K	G	E	G	M	E	General versatility	Unpleasant solvents, heat	E	E	G	E	E	E	E	E	E	G	14, 23, 29, 34, 45, 46
			R	Cl, H, K, W	G	E	G	M	E	General versatility	Unpleasant solvents, heat	E	E	G	E	E	E	E	E	E	G	14, 23, 29, 34, 45, 46
		Butadiene-styrene	SR	Cl, H, K, W	G	M	M	M	E	Good for wood to paper	Non-curing	E	P	F	P	F	F	M	G	P	P	14, 23, 29, 34, 45, 46
		Thiokol	SR	Cl, H, W	M	M	M	M	E	General utility	Unpleasant odor	M	F	M	F	P	F	M	M	M	P	2, 6, 10, 29, 34
			V	Cl, H	M	M	G	G	E	Good adhesion to metals		M	G	E	G	G	G	G	G	G	M	2, 6, 29, 34
		Cyclized rubber	SR, F	Cl, H	E	F	F	M	E	Flexibility and strength	Moderate low temp. flexibility	F	M	E	P	E	P	P	E	E	P	2, 23, 34, 40, 45, 47
		Chlorinated rubber	SR, F	E, H, K	M	P	M	M	E	General utility	Turns brittle with age	M	M	M	M	G	M	M	G	G	P	2, 28, 29, 33, 34, 40, 43, 45
Protein adhesives		Casein	SR	W	P	G	M	M	P	Ease of application	Poor resistance to water and fungus	M	P	P	P	P	F	F	G	M	P	3, 5, 9, 10, 26, 28, 29, 31, 33, 38, 43, 45, 49
		Blood albumin	R	W	P	G	F	F	P	Hard, clear film, ease of application	Poor resistance to water and fungus	F	P	P	P	P	P	G	G	G	P	4
		Blood albumin	M	W	M	G	M	M	P	Hard, clear, water resisting film. Heat sets instantly	Poor resistance to fungus. Film not flexible unless plasticized.	G	G	P	P	P	P	G	G	E	P	4
		Soluble dried blood	R	W	P	G	F	F	P	Hard film, ease of application	Poor resistance to water and fungus	M	P	P	P	P	P	G	G	G	P	4, 50
		Soluble dried blood	M	W	M	G	M	M	P	Hard water resisting film. Heat sets instantly	Poor fungus resistance, not flexible, dark	G	G	P	P	P	P	E	E	E	P	4, 50
		Animal glue	SR	W	P	G	M	G	P	Very fast set, ease of application	Poor resistance to water and fungus	E	P	P	M	P	P	E	E	E	P	4, 5, 9, 28, 29, 33, 43, 44, 45, 49
		Soybean	SR	W	P	M	F	P	P	Ease of application	Poor resistance to water and fungus	F	P	P	F	P	F	F	G	M	P	10, 26, 29
Miscellaneous adhesives		Asphalt	H, W	H	G	P	P	G	E	Cold resistance, permanent tack	Poor heat resistance	M	G	G	G	G	M	G	G	F		10, 29, 33
		Shellac	H	H	G	P	M	M	E	Clarity, ease of application	Poor solvent resistance	G	G	G	M	M	M	M	G	G	F	2, 29, 45, 48
		Starch and dextrin	SR	W	P	M	P	P	P	Speed of bonding to paper	Weak film, poor water resistance	P	P	P	P	P	F	M	M	P		3, 5, 9, 14, 28, 33, 38, 44, 45, 49
		Oleo-resin	SR, R	H	G	G	G	M	E	Water resistant	Slow dry, time required to develop full strength	G	G	P	G	F	G	G	G	G	G	16, 28

[a] Code for Bonding Classification:
SR = Solvent released
F = Fused by heating
V = Vulcanized
R = Cured at room temperature (70–80° F.)
M = Cured at moderate temperature (150–200° F.)
H = Cured at elevated temperature (275–310° F.)

[b] Code for Solvents:
A = Alcohols
Cl = Chlorinated hydrocarbons
E = Fatty acid esters
H = Aromatic hydrocarbons
K = Ketones
W = Water

[c] Code for Rating:
E = Excellent
G = Good
M = Moderate
F = Fair
P = Poor

[d] Code for Manufacturers:
1. American Cyanamid Co., Plastics Div., 30 Rockefeller Plaza, New York 20, N. Y.
2. Angier Products Inc., 120 Potter St., Cambridge 42, Mass.
3. Arabol Mfg. Co., 110 E. 42nd St., New York 17, N. Y.
4. Armour and Co., 1355 W. 31st St., Chicago 9, Ill.
5. Atlas Gum and Sizing Co., 406 Pearl St., New York 7, N. Y.
6. B. B. Chemical Co., 784 Memorial Drive, Cambridge 39, Mass.
7. Bakelite Corp., 30 E. 42nd St., New York 17, N. Y.
8. Barrett Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.
9. Bingham Brothers Co., 406 Pearl St., New York 7, N. Y.
10. Casein Co. of America, 350 Madison Ave., New York 17, N. Y.
11. Catalin Corp., 1 Park Ave., New York 16, N. Y.
12. Columbia Chem. Div., Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh 19, Pa.
13. Cycleweld Div., Chrysler Corp., Detroit 31, Mich.
14. Dewey and Almy Chemical Co., 62 Whittemore Ave., Cambridge 40, Mass.
15. Dispersions Process, Inc., Rockefeller Center, New York 20, N. Y.
16. Dolphin Paint and Varnish Co., Champlain and Locust Sts., Toledo, Ohio
17. Dow Chemical Co., Midland, Mich.
18. E. I. du Pont de Nemours and Co., Inc., 626 Schuyler Ave., Arlington, N. J.
19. Durez Plastics and Chemicals, Inc., North Tonawanda, N. Y.
20. Durite Plastics, Inc., 5000 Summerdale Ave., Philadelphia 24, Pa.
21. Furane Plastics and Chemicals Co., 4500 Brazil St. at San Fernando Road, Los Angeles 26, Calif.
22. General Electric Co., Schenectady, N. Y.
23. B. F. Goodrich Co., 500 S. Main St., Akron 18, Ohio
24. Heresite & Chemical Co., Manitowoc, Wis.
25. Interlake Chemical Corp., Plastics Div., 1911 Union Commerce Bldg., Cleveland 14, Ohio
26. I. F. Laucks Co., 911 Western Ave., Seattle 4, Wash., and Lockport, N. Y.
27. Marco Chemicals, Inc. Sewaren, N. J.
28. Midland Glue Products Co., 1484 Madison Ave., Detroit 7, Mich.
29. Minnesota Mining and Mfg. Co., 900 Fauquier Ave., St. Paul 6, Minn.
30. Miracle Adhesives, Inc., 852 Clinton Ave., Newark 8, N. J.
31. Monite Waterproof Glue Co., Minneapolis, Minn.
32. Monsanto Chemical Co., Plastics Div., Springfield 2, Mass.
33. National Adhesives Corp., 270 Madison Ave., New York 16, N. Y.
34. Naugatuck Chemical Div., U. S. Rubber Co., Rockefeller Center, New York 20, N. Y.
35. Neville Co., Neville Island, Pittsburgh 25, Pa.
36. Pennsylvania Coal Products Co., Petrolia, Pa.
37. Pennsylvania Industrial Chemical Co., Clairton, Pa.
38. Perkins Glue Co., Lansdale, Pa.
39. Plaskon Div., Libbey-Owens-Ford Glass Co., 2112 Sylvan Ave., Toledo 6, Ohio.
40. Pyroxylin Products and Chemicals Co., 4851 S. St. Louis Ave., Chicago 32, Ill.
41. Resinous Products and Chemical Co., 222 W. Washington Sq., Philadelphia 5, Pa.
42. Shawinigan Products Corp., 350 Fifth Ave., New York 1, N. Y.
43. So-Lo Works, Inc., Loveland, Ohio
44. Swift and Co., 4115 Packers Ave., Chicago 9, Ill.
45. Union Paste Co., 1605 Hyde Park Ave., Hyde Park, Mass.
46. U. S. Rubber Co., Rockefeller Center, New York 20, N. Y.
47. U. S. Stoneware Co., Akron 9, Ohio.
48. G. A. Wharry and Co., Inc., 95 Broad St., New York 4, N. Y.
49. Williamson Adhesives, Inc., 2327 W. 18th St., Chicago 8, Ill.
50. Wilson and Co., Inc., 4100 S. Ashland St., Chicago 9, Ill.

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SYNTHETIC RUBBER—1947

PROPERTIES	CHEMIGUM		NEOPRENE
	Type N-4	Latex Type 101[c]	Types E, FR, KNR, CG, S, NC
Chemical Type	nitrile copolymers	Butadiene-styrene copolymer	Chlorobutadiene polymer
Specific gravity (gum)	0.98	0.98	1.15–1.24
Refractive index (gum)	—	—	1.5580 @ 25°
Tensile strength, p.s.i.	Up to 3200	2200	Up to 4700
Elongation at break, %	Up to 800	530	Up to 1100
Volume resistivity, ohm-cm. at 25° C	Approx. 10^9	Approx. 10^{15}	—
Dielectric strength, short-time test, volts per mil	—	—	—
Dielectric constant	14 @ 1000 cycles	2.9 @ 1000 cycles	—
Power factor	0.1 @ 1000 cycles	0.004 @ 1000 cycles	—
Swelling in kerosene, % by volume	Up to 5	High	—
Swelling in gasoline, % by volume	Up to 5	High	—
Swelling in benzene, % by volume	Very high	Very high	—
Swelling in acetone, % by volume	Very high	Slight	—
Swelling in alcohol, % by volume	0	Insoluble	—
Swelling in carbon tetrachloride, % b	High	—	—
Swelling in lubricating oil, % by vol	Up to 5	—	—
Maximum service temperature, °F.	300	300	300
Abrasion resistance	Excellent	Excellent	Excellent
Durometer hardness	10–100	—	—
Compression set,[a] minimum, %	—	—	—

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FIBERS PROPERTIES CHART - 1947

PROPERTIES	GLASS	NYLON		PROTEIN		RAYON						VINYL RESIN			VINYLIDENE CHLORIDE	COTTON	SILK	WOOL	PROPERTIES
						ACETATE		Saponified acetate	Cuprammonium	VISCOSE									
		Regular	High tenacity	Casein	Soybean	Regular	High impact			Regular	Medium tenacity	High tenacity	Regular	High tenacity	Staple				
Dimensions of fibers																			Dimensions of fibers
Continuous length	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	—	—	—	Yes	No	400 to 1300 yards	No	Continuous length
Staple length, in.	Up to 18	1 to 5	1 to 5	½ to 6	½ to 6	½ to 7	½ to 7	Experimental	No	1 to 8	1 to 8	1 to 8	—	—	1 to 5	No	½ to 2½	Yes	1½ to 15	Staple length, in.
Width, microns	5–16	10–100	10–100	15–27	14–27	11–46	11–46	ca. 10	ca. 11	10–43	10–43	10–43	16–18	16–18	16–18	100–1300	12–20	9–11	10–70	Width, microns
Specific gravity	2.54	1.14	1.14	1.29	1.305	1.30–1.35	1.30–1.35	1.52	1.54	1.50–1.54	1.50–1.54	1.50–1.54	1.33–1.36	1.33–1.36	1.33–1.36	1.60–1.75	1.50–1.55	1.25–1.35	1.28–1.33	Specific gravity
Tensile strength																			Tensile strength
Dry, g./denier	6.3–6.9	3.5–5.7	6.0–8.0	0.6–1	0.85	1.2–1.5	1.3–1.8	7.0	1.7–2.3	1.5–2.4	2.4–3.0	3.0–4.0	2.0–2.8	3.5–4.4	0.6–0.7	1.1–2.9	2.1–6.3	2.8–5.2	1.0–1.7	Dry, g./denier
Dry, p.s.i.	205,000–212,000	51,000–117,000	51,000–117,000	10,000–16,000	14,000	20,000–25,000	22,000–30,000	136,000	33,000–42,000	29,000–47,000	47,000–58,000	58,000–78,000	35,000–48,000	56,000–76,000	10,000–12,000	25,000–60,000	42,000–123,000	45,000–83,000	17,000–28,000	Dry, p.s.i.
Wet, percent of dry strength	99	85–90	85–90	75–80	40	60–65	50–75	85	56	44–54	62	45–66	100	100	100	100	110–130	75–95	76–97	Wet, percent of dry strength
Ultimate elongation at 65% R.H., percent	2.0–3.75	20–25	14–16	7–60	40	23–30	45–50	6	10–17	15–30	12–20	9–19	14–35	16–20	10–13	15–25 (unoriented) 29–30 (oriented)	3–10	13–31	20–50	Ultimate elongation at 65% R.H., percent
Recovery from strain*																				Recovery from strain*
Strain, percent	3	2 | 20	2 | 20	5 | 20	—	2 | 20	2 | 20	2 | 5	5 | 15	2 | 20	2 | 20	2 | 20	2 | 20	2 | 20	2 | 20	—	2 | 5	2 | 20	2 | 20	Strain, percent
Recovery, percent	100	100 | 75	100 | 75	60 | 36	—	94 | 23	94 | 23	82 | 67	48 | 32	82 | 30	82 | 30	82 | 30	99 | 63	99 | 63	99 | 63	—	74 | 45	92 | 33	99 | 63	Recovery, percent
Modulus of elasticity																				Modulus of elasticity
Static method,[1] 10^3 dynes/cm.[3]	55.2[2]	2.3–3.8	2.3–3.8	2.6	2.6–4.6[2]	3.0–4.8	3.0–4.8	20.6–24.5	9.2	6.4–9.1	—	9.9–23.6	3.3–4.5[2]	3.3–4.5[2]	3.3–4.5[2]	0.3–1.7	5.7–11.2	8.4–12.9	2.7–3.9	Static method,[1] 10^3 dynes/cm.[3]
Static method,[1] g./denier	246[2]	23–38	23–38	23	23–40[2]	26–41	26–41	152–183	68	45–68	—	74–176	28–38[2]	28–38[2]	28–38[2]	2–11	42–82	76–117	24–34	Static method,[1] g./denier
Velocity of sound method,[4] 10^3 dynes/cm.[3]	—	—	—	—	—	6.1	6.1	—	—	11.5	—	33.8	—	—	—	—	—	14.4	5.1	Velocity of sound method,[4] 10^3 dynes/cm.[3]
Velocity of sound method,[4] g./denier	—	—	—	—	—	52	52	—	—	86	—	232	—	—	—	—	—	130	44	Velocity of sound method,[4] g./denier
Stiffness,[5] average, g./denier	230	20	45	2.4	2.1	5.2	5.3	120	14	8.7	17	25	9.6	22	5.8	10	60	18	5.9	Stiffness,[5] average, g./denier
Toughness index,[6] g.-cm./denier cm.	0.09	0.53	0.52	0.13	0.17	0.19	0.36	0.21	0.14	0.23	0.22	0.25	0.30	0.36	0.04	0.20	0.15	0.41	0.25	Toughness index,[6] g.-cm./denier cm.
Moisture regain at 20° C. and 65% R.H., percent	0	3.5–4.0	3.5–4.0	13.0 (at 70° F.)	15.5	6.3–6.5	6.3–6.5	10.0–11.5	11.0	11.5–16.5	11.5–16.5	11.5–16.6	0	0	0	0	8.5	11.0	17.0	Moisture regain at 20° C. and 65% R.H., percent
Swelling in water,[7] percent	0	Slight	Slight	—	5	6–30	6–30	—	99–134	45–82	45–82	45–82	0	0	0	0	44–49	30–41	32–38	Swelling in water,[7] percent
Refractive index																				Refractive index
Epsilon[7]	1.55 ± .01	1.520	1.520	—	—	1.478	1.478	1.547	1.548	1.547	1.547	1.547	1.536	1.536	1.536	1.560–1.63	1.580	1.591	1.556	Epsilon[7]
Omega[8]	1.55 ± .01	1.520	1.520	—	—	1.473	1.473	1.513	1.527	1.521	1.521	1.521	1.536	1.536	1.536	1.560–1.63	1.533	1.538	1.547	Omega[8]
Dielectric constant	6.3 at 60 cy. 6.3 at 1 mc. 5.8 at 10 mc. 5.6 at 37 mc.	4.0 at 1 kc. (at 18% R.H.) 20.0 at 1 kc. (wet)				3.8 at 60 cy. (at 0% R.H.) 5.0 at 60 cy. (at 50% R.H.)		6.0 at 60 cy. (at 50% R.H.)	—	—	—	—	—	—	—	3.0–5.0 at 60 cy., 1 kc., 1 mc.	—	4.2 at 500 kc., 4 mc., 10 mc.	4.2 at 13 mc. 500 kc., 120 kc. 4.8 at 20 kc. 5.4 at 8 kc.	Dielectric constant
Effect of age	None	Slight yellowing	Slight yellowing	None	None	Slight loss of tensile strength		Virtually none	Virtually none	Slight yellowing	Slight yellowing	Slight yellowing	None	None	None	None	Virtually none	Slight yellowing; slight loss of tensile strength	Slight yellowing; slight loss of tensile strength	Effect of age
Effect of heat																				Effect of heat
Strength loss temperature, ° F.	600	284	284	212	—	194–225	194–225	212	—	266	266	266	—	—	—	160–200	&	&	&	Strength loss temperature, ° F.
Softening temperature, ° F.	1500	482	482	Decomposes at 450	Decomposes at 400 Sinters at 575	397–406	397–406	—	Decomposes above 300	Decomposes at 350–400	Decomposes at 350–400	Decomposes at 350–400	Melts at 260 Shrinks at 150	Melts at 260 Shrinks at 150	Melts at 260 Shrinks at 150	290–325	—	—	—	Softening temperature, ° F.
Effect of sunlight, prolonged exposure	None	Loss of tensile strength	Loss of tensile strength	Similar to wool	Similar to wool	Loss of tensile strength	Loss of tensile strength	—	Loss of tensile strength	Loss of tensile strength	Loss of tensile strength	Loss of tensile strength	None	None	None	Darkens slightly	Loss of tensile strength; tendency for whites to yellow	Loss of tensile strength; affected more than cotton	Loss of tensile strength; change in dyeing properties; less affected than cotton	Effect of sunlight, prolonged exposure
Resistance to moths[9]	Not attacked	Not attacked	Not attacked	Attacked	Resistant	Not attacked	Not attacked	Not attacked	Not attacked	Not attacked	Not attacked	Not attacked	Not attacked	Not attacked	Not attacked	Not attacked	Not attacked	May be attacked, but more resistant than wool	Attacked	Resistance to moths[9]
Resistance to mildew*	Not attacked	Not attacked	Not attacked	Similar to wool	Similar to wool	Resistant	Resistant	Similar to cotton	Attacked	Attacked	Attacked	Attacked	Not attacked	Not attacked	Not attacked	Not attacked	Attacked, especially if sized	Not usually attacked	May be attacked, but more resistant than cotton	Resistance to mildew*
Effect of strong acids	Attacked by hydrofluoric and hot phosphoric	Hydrolyzed by concentrated; loss of strength after several hr. at 100° F. by dilute		Decomposed	Embrittled	Decomposed	Decomposed	Decomposed	Disintegrated by hot dilute or cold concentrated	Similar to cotton	Similar to cotton	Similar to cotton	Stable	Stable	Stable	Stable	Disintegrated by hot dilute or cold concentrated	Dissolved	Destroyed by hot sulfuric; resistant to others	Effect of strong acids
Effect of weak acids	Stable	Varies with nature of acid and concentration	Varies with nature of acid and concentration	Stable	Stable	Dissolved by certain weak organic acids, such as acetic	Dissolved by certain weak organic acids, such as acetic	Resistant	Similar to viscose	Strength deterioration on prolonged contact or hot			Stable	Stable	Stable	Stable	Stable if cold; strength deterioration if hot	Fairly resistant	Resistant	Effect of weak acids
Effect of strong alkalis	Attacked	None or slight	None or slight	Decomposed	Embrittled	Saponified	Saponified	Swelling and mercerization; loss of strength in hot concentrated	Swelling and loss of strength	Swelling and loss of strength	Swelling and loss of strength	Swelling and loss of strength	Stable	Stable	Stable	Stable to most; limited resistance to ammonia	Swelling and mercerization	Dissolved	Attacked	Effect of strong alkalis
Effect of weak alkalis	Attacked if hot	Little effect	Little effect	Little effect for short period; embrittled on prolonged contact; decomposed if hot	Little effect	Little or no effect for short periods cold; saponification on long standing or hot		Little effect	Little effect if dilute	No effect cold; reduced strength hot or on prolonged contact			Stable	Stable	Stable	Stable	Little effect	Attacked if hot	Attacked if hot	Effect of weak alkalis
Effect of organic solvents	Insoluble	Unaffected by dry cleaning solvents. Soluble in phenol, formic acid, m-cresol, xylenol in cold		Resistant	Resistant	Insoluble in dry cleaning solvents generally; swollen or dissolved in acetone, ethyl acetate, many ketones and esters, glacial acetic acid, phenol, and some chlorinated solvents. Softened or slightly softened in alcohol		Resistant	Resistant	Resistant	Resistant	Resistant	Soluble in ketones and some chlorinated hydrocarbons; swells and softens in ethers, esters, aromatic hydrocarbons, dioxan, propylene oxide			Resistant; swelled or softened by oxygen-bearing solvents, such as cyclohexanone and dioxan, at elevated temperatures	Resistant	Resistant	Resistant	Effect of organic solvents
Dyes used	Resin-bonded pigments and soluble vats. Developed, direct, and acid dyes are in experimental stage	Acetate or acid dyes are preferred; direct, chrome, pigment, and other classes can be used with proper formulation and treatment		Dyes by most classes except some direct. Vat dyes unsuitable because of alkali required	Fast acid, chrome, and vat dyes	Special acetate dyestuffs; selected vats and azo colors; some acid and basic dyes; pigment dyes; solvent (swelling) dyeing		Generally dyes used for cotton	Same as for viscose rayon	Acid (for tinting only); basic; direct; vat; naphthols; sulfur			Dispersed dyes with aid of certain swelling agents; solvent methods; pigment dyeing			Colored before extrusion	Basic, direct, mordant, sulfur, vat, naphthols	Acid, basic, direct, mordant, naphthols, vat	Acid, basic, direct, mordant, vat	Dyes used

* With the exception of glass fiber, for which testing conditions were not reported, the values for elastic recovery were obtained at 20° C. and 65% relative humidity; rate of loading 10 g./denier/min.; duration of action of load 30 sec.; recovery time 60 sec.

[1] Except as otherwise noted, all values by the static method were obtained under the same conditions described in footnote (a).

[2] Air-dry.

[3] Testing conditions not reported.

[4] All values by the velocity of sound method were obtained in air-dry condition.

[5] Stiffness (resistance to deformation) is the ratio of breaking stress to breaking strain: P/E, where P is the stress in grams per denier required to produce rupture and E is the strain in centimeters per gauge centimeter at breaking stress.

[6] Toughness (the ability to absorb work), expressed as a toughness index, is the work per unit volume of material which would cause rupture if the stress-strain curve were a straight line: PE/2.

[7] Values pertain to cross section area increase, essentially equivalent to volumetric swelling.

[8] Index for light vibrating perpendicular to the long fiber axis.

[9] Index for light vibrating parallel to the long fiber axis.

[10] Since the effect of heat on natural fibers is not critical, but varies widely with temperature, duration of heating, atmosphere in which tested, previous history of fiber, etc., it is believed that the arbitrary assignment of values would be meaningless.

[11] Many materials are subject to attack by moths if they contain edible finishes. Also, larvae may cut their way out if trapped.

* Resistance of yarns and fabrics to mildew depends in many cases upon the nature of the finishing materials used.

This compilation of the principal physical and chemical properties of the commercially important textile fibers was prepared by Robert Wright and Milton Harris, Milton Harris Associates. Data appearing in the chart have been assembled from responses to a questionnaire to manufacturers, the International Critical Tables, Textile World's Synthetic Fiber Table, A.S.T.M. Standards on Textile Materials, and from information reported by the following individuals: W. D. Appel, P. W. Carlene, Jacques Errera and Henri Sack, J. I. M. Jones, H. Mark, J. M. Matthews, Reginald Meredith, R. F. Nickerson, L. A. Olney, Emil Ott, and H. deW. Smith, as well as from measurements made in the laboratory of Milton Harris Associates.

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SYNTHETIC RUBBERS PROPERTIES CHART—1947

The values for the properties in the accompanying chart are based upon data submitted by the manufacturers or published in technical literature. Differences in compounding, test procedures, and sizes of test specimens may lead to erroneous conclusions in some cases if direct comparisons are attempted. Special grades of materials are available which excel in particular properties. The manufacturers should always be consulted before making a choice of material. In order to facilitate communication with the producers of these materials, the names and addresses of manufacturers of each of these synthetic rubbers are listed at the bottom of each section of the chart. The properties of elastomeric products prepared from polyvinyl chloride-acetate and polyvinyl chloride as covered by A.S.T.M. Specifications D 742-46T and D744-44T are listed on pages 743 and 742 respectively

PROPERTIES	*BUTAPRENE*				*HYCAR*			*CHEMIGUM*			*NEOPRENE*
	Type NXM-S	Type NAA	Type NL-S	Type NF-S	Type OR-15	Type OR-25	Type OS-10	Type N-3	Type N-4	Latex Type 101[c]	Types E, FR, KNR, CG, S, NC
Chemical Type	Butadiene copolymers				Butadiene-acrylonitrile copolymer	Butadiene-acrylonitrile copolymer	Butadiene-styrene copolymer	Butadiene-acrylonitrile copolymers		Butadiene-styrene copolymer	Chlorobutadiene polymer
Specific gravity (gum)	1.00	1.00	0.98	0.96	1.00	0.98	0.98	1.00	0.98	0.98	1.15–1.24
Refractive index (gum)	—	—	—	—	—	—	—	—	—	—	1.5580 @ 25°
Tensile strength, p.s.i.	2000–4000	2000–4000	2000–3500	1500–2500	Up to 4000	Up to 3500	Up to 3000	Up to 4000	Up to 3200	2200	Up to 4700
Elongation at break, %	400–800	375–750	350–700	350–500	Up to 800	Up to 700	Up to 700	Up to 800	Up to 800	530	Up to 1100
Volume resistivity, ohm-cm. at 25° C.	—	—	—	—	10^2–10^{10}	10^2–10^{10}	5×10^{15}	Approx. 10^9	Approx. 10^9	Approx. 10^{15}	—
Dielectric strength, short-time test, volts per mil	—	—	—	—	500	500	750	—	—	—	—
Dielectric constant	19 @ 1000 cycles	15 @ 1000 cycles	15 @ 1000 cycles	—	20 @ 60 cycles	20 @ 60 cycles	2.9 @ 60 cycles	14 @ 1000 cycles	14 @ 1000 cycles	2.9 @ 1000 cycles	—
Power factor	0.075 @ 1000 cycles	0.80 @ 1000 cycles	0.081 @ 1000 cycles	—	—	—	—	0.1 @ 1000 cycles	0.1 @ 1000 cycles	0.004 @ 1000 cycles	—
Swelling in kerosene, % by volume	—	—	—	—	−5 to +10	−5 to +15	+75 to +100	−5 to +5	Up to 5	High	—
Swelling in gasoline, % by volume	0 to +6	+2 to +8	+3 to +10	+8 to +15	−5 to +10	−5 to +15	+75 to +100	−5 to +5	Up to 5	High	—
Swelling in benzene, % by volume	+80 to +140	+100 to +160	+150 to +200	—	+75 to +125	+100 to +150	+150 to +250	High	Very high	Very high	—
Swelling in acetone, % by volume	—	—	—	—	+100 to +200	+150 to +250	+15 to +30	High	Very high	Slight	—
Swelling in alcohol, % by volume	—	—	—	—	+3 to +10	+3 to +10	−5 to +10	−5 to 0	0	Insoluble	—
Swelling in carbon tetrachloride, % by volume	+40 to +70	+60 to +100	—	—	+25 to +40	+35 to +50	+200 to +250	Moderate	High	—	—
Swelling in lubricating oil, % by volume[b]	−3 to +3	−2 to +4	0 to +6	+10 to +40	−15 to +10	−15 to +15	+100 to +150	0 to +5	Up to 5	—	—
Maximum service temperature, °F.	300	300	300	250	250 to 300	250 to 300	212–250	300	300	300	300
Abrasion resistance	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
Durometer hardness	—	—	—	—	10–100	10–100	20–100	10–100	10–100	—	—
Compression set,[a] minimum, %	—	—	—	—	7	4	8	5	—	—	—
Manufacturer	Firestone Tire and Rubber Co. Akron, Ohio				B. F. Goodrich Chemical Co. Cleveland 15, Ohio			Goodyear Tire and Rubber Co. Akron 16, Ohio			E. I. du Pont de Nemours & Co., Inc. Wilmington 98, Del.

PROPERTIES	*RESISTOFLEX COMPAR*	*GR-S*	*GR-I*	*GR-M GR-M10*	*PERBUNAN*			*VISTANEX* (Synthetic 100)	*THIOKOL*		
	(Compounded and modified)	—	(Butyl)	—	Type 18	Type 26	Type 35	—	Type A	Type FA	Type ST
Chemical Type	Polyvinyl alcohol	Butadiene-styrene copolymer	Isoprene-isobutylene copolymer	Chlorobutadiene polymer	Butadiene-acrylonitrile copolymers			Polyisobutylene (polybutene)	Organic polysulfide		
Specific gravity (gum)	1.26	0.94	0.91	1.15–1.24	0.96	0.97	0.98	0.91	1.60	1.34	1.27
Refractive index (gum)	—	1.5339–1.5348	—	1.5580 @ 25°	—	1.521	—	1.509	—	—	—
Tensile strength, p.s.i.	2000–6000	Up to 3000	Up to 2800	Up to 4000	Up to 3500	Up to 3500	Up to 4000	1500	790	1200–1400	1200–2000
Elongation at break, %	300–600	Up to 650	Up to 750	Up to 800	100–700	100–700	100–700	600	370	450–570	300–700
Volume resistivity, ohm-cm. at 25° C.	10^2–10^8	—	10^{15}	—	10^2–10^{10}	10^2–10^{10}	10^2–10^{10}	5×10^{13}	—	—	—
Dielectric strength, short-time test, volts per mil	—	—	—	—	—	—	—	—	—	—	—
Dielectric constant	—	2.85 @ 1000 cycles	2.1 @ 1000 cycles	Approx. 7.5 @ 1000 cycles	15 @ 60 cycles	15 @ 60 cycles	15 @ 60 cycles	2.29 @ 1000 cycles	—	—	—
Power factor	—	0.003 @ 1000 cycles	0.0004 @ 1000 cycles	Approx. 0.03 @ 1000 cycles	—	—	—	0.0004 @ 1000 cycles	—	—	—
Swelling in kerosene, % by volume	−0.3 to +0.5	+60 to +150	+100 to +800	+10 to +45	—	—	—	Soluble	0	2.5	2.5
Swelling in gasoline, % by volume	−0.3 to +0.7	+75 to +200	+150 to +400	+10 to +45	+5 to +15 (SR-10)[b]	−5 to +10 (SR-10)[b]	−10 to +5 (SR-10)[b]	Soluble	0	2.5	2.5
Swelling in benzene, % by volume	0 to +0.5	+175 to +450	+100 to +200	+100 to +400	+65 to +80 (SR-6)[b]	+30 to +60 (SR-6)[b]	+10 to +20 (SR-6)[b]	Soluble	7	—	—
Swelling in acetone, % by volume	−1.2	+10 to +30	0 to +10	+15 to +50	—	100–200	—	Insoluble	0	20	22
Swelling in alcohol, % by volume	−4.3	0 to +10	0 to +5	+5 to +20	−10 to 0	−5 to +5	−5 to +5	Insoluble	—	—	3
Swelling in carbon tetrachloride, % by volume	0	+175 to +450	+200 to +500	+100 to +200	—	120	60	—	0	40	50
Swelling in lubricating oil, % by volume	0.9	+50 to +400	500	0 to +150	0 to +10 (Oil #1)[b]	−10 to +5 (Oil #1)[b]	−10 to 0 (Oil #1)[b]	Soluble	0	3	2
Swelling in petroleum base Oil #3[b], % by vol.	0.4	Like rubber	Like rubber	—	+30 to +40	+10 to +20	+5 to +15	—	—	—	—
Maximum service temperature, ° F.	250–275	300	300	300	300	300	300	—	200	200	250–300
Abrasion resistance	Excellent	Excellent	Fair	Good	Excellent	Excellent	Excellent	Good	Good	Good	Good
Manufacturer	Resistoflex Corp., Belleville 9, N. J.	Office of Rubber Reserve, Reconstruction Finance Corp., Washington 25, D. C.			Stanco Distributors, Inc., Chemical Products Dept., 26 Broadway, New York 4, N. Y.; Standard Oil Co. of N. J. (Louisiana Div.)				Thiokol Corp., Trenton 7, N. J.		

[a] ASTM D 395-40T, Method B.
[b] Standard compositions for these immersion media will be found in A.S.T.M. D471-44T; data for SR-6 and SR-10 fuels are for 168 hr. immersion at 68°F. (20°C.); data for Oil #1 are for 70 hr. immersion at 212°F. (100°C.); data for Oil #3 are for 70 hr. immersion at 300 °F. (149°C.).
[c] Properties are for sheet prepared from evaporated compounded latex except specific gravity which is based on the dried latex film.

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LOW PRESSURE LAMINATING RESINS CHART - 1947

10a LAMINATING CHART

Manufacturer	Resin: Company number	Resin: Identity	Price: Price /lb./ carload f.o.b.	Physical characteristics of uncured resin: Solids	Viscosity	pH	Solvents	Storage: Conditions	Storage: Life	Modifications	Resin content	Catalysts	Inhibitors	Treater operations: Impregnation: Apparatus	Impregnation: Preparation of resin	Volatile content	Flow	Drying: Apparatus	Drying: Optimum oven temp.	Drying: Time	Storage: Temp.	Storage: Life	Curing operations: Mold release agent	Curing operations: Equipment: Presses	Equipment: Molds	Equipment: Ovens	Curing cycle: Optimum pressure	Curing cycle: Optimum temp.	Curing cycle: Thickness	Curing cycle: Time	Heat distortion point: Cast resin temp.	Heat distortion point: Laminate temp.	Electrical properties of cast resin: Freq. 60 cycles: Power factor	Freq. 60 cycles: Dielectric constant	Freq. 60 cycles: Loss factor	Freq. 10⁶ cycles: Power factor	Freq. 10⁶ cycles: Dielectric constant	Freq. 10⁶ cycles: Loss factor	Freq. 10⁸ cycles: Power factor	Freq. 10⁸ cycles: Dielectric constant	Freq. 10⁸ cycles: Loss factor	Dielectric strength: Short time	Dielectric strength: Step-by-step	Arc resistance	End application	General notes
			$	%	cp.						%					%	%		°F.		°F.						p.s.i.	°F.	in.		°F.	°F.										v./mil	v./mil	sec.		
AMERICAN CYANAMID CO. PLASTICS DIV. 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.	Laminac 4116	Unsaturated polyester resin	0.40	100	25° C. 300 to 380	Neutral	Acetone, alcohols, ammonia	No catalyst in dark: 32° F. / 77° F. / 104° F.	1 yr. / 3 mo. / 3 to 4 wk.	Copolymerised with monostyrene	38 to 45	2.0% by weight of Luperco ATP-1 (extended benzoyl peroxide). 1% Alperox	Lead, Copper, Bronze, Rubber	Dip tank Squeese rolls Brush coating Spreading	Add catalyst to cold resin. Agitate without introduction of air	May lose styrene 10% of weight					77° / 104°	2-3 days / 2-3 hr. in cellophane	Cellophane, polyvinyl alcohol, cellulose acetate. 10% sol'n of PVA in H₂O with Aerosol. Vejin AsC in 98% gasoline	Conventional type	All conventional types	All conventional types	Contact to 100	220 at center of laminate	Any thickness	20 min.	175	545													Decorative applications, semi-structural applications.	Very suitable for postforming applications where simple bends and shallow draws are required. Shrinkage during cure 8%. Can use special Calco pigments to color resin.
	Laminac 4125	Unsaturated polyester resin	0.40	100	25° C. 370 to 440	Neutral	Acetone, alcohols, ammonia	No catalyst in dark: 32° F. / 77° F. / 104° F.	1 yr. / 3 mo. / 3 to 4 wk.	Copolymerised with monostyrene	38 to 45	2.0% by weight of Luperco ATP-1 (extended benzoyl peroxide).	Lead, Copper, Bronze, Rubber	Dip tank Squeese rolls Brush coating Spreading	Add catalyst. Agitate without introduction of air into cold resin	May lose styrene 10% of weight					77° / 104°	1 wk. / < 1 day in cellophane	Cellophane, polyvinyl alcohol, cellulose acetate. 10% sol'n of PVA in H₂O with Aerosol. Vejin AsC in 98% gasoline	Conventional type	All conventional types	All conventional types	Contact to 100	220	Any thickness	20 min.	195	545													Decorative applications, semi-structural applications.	Shrinkage during cure 8%. Can use special Calco pigments to color resin.
	Laminac 4134	Unsaturated polyester resin	0.40	100	250	Neutral	Acetone, alcohols, ammonia	No catalyst in dark: 32° F. / 77° F. / 104° F.	1 yr. / 3 mo. / 3 to 4 wk.	Copolymerised with monostyrene	38 to 45	2.0% by weight of Luperco ATP-1 (extended benzoyl peroxide)	Lead, Copper, Bronze, Rubber	Dip tank Squeese rolls Knife coating	Melt resin in water bath at 120 to 130° F. Stir in catalyst						77° / 104°	3 wk. / 1 day in cellophane	Glassine paper, cellophane, polyvinyl alcohol, cellulose acetate. 10% sol'n of PVA in H₂O with Aerosol. Vejin AsC in 98% gasoline	Conventional type	All conventional types	All conventional types	Contact to 100	220	Any thickness	20 min.	195	545													Decorative applications, semi-structural applications.	A flexible resin. Very short cure cycle. Shrinkage during cure 8%. Can use special Calco pigments to color resin. Blended with 4116 or 4125 for intermediate properties.
	Laminac 4140	Unsaturated polyester resin	0.55	100	275 to 2000	Neutral	Acetone, alcohols, ammonia	No catalyst in dark: 32° F. / 77° F. / 104° F.	1 yr. / 3 mo. / 3 to 4 wk.	Copolymerised with monostyrene	38 to 45	2.0% by weight of Luperco ATP-1 (extended benzoyl peroxide)	Lead, Copper, Bronze, Rubber	Dip tank Squeese rolls Brush coating Spreading	Add catalyst. Agitate without introduction of air into cold resin	May lose styrene 10% of weight					77° / 104°	1 wk. / < 1 day in cellophane	Cellophane, polyvinyl alcohol, cellulose acetate. 10% sol'n of PVA in H₂O with Aerosol. Vejin AsC in 98% gasoline	Conventional tional	All conventional types	All conventional types	Contact to 100	220	Any thickness	20 min.	195	545													Decorative applications, semi-structural applications.	A fire-resistant formulation producing laminates which are self-extinguishing when used with fire-retarding treated fabrics. Low shrinkage. Can use special Calco pigments to color resin.
	Laminac 4201	Unsaturated polyester resin	0.45	100	25° C. 170,000 90° C. 300	Neutral	Acetone, alcohols, ammonia	No catalyst in dark: 32° F. / 77° F. / 104° F.	1 yr. / 3 mo. / 3 to 4 wk.	Copolymerised with an allyl ester	38 to 45	2.0% by weight of Luperco ATP-1 (extended benzoyl peroxide)	Lead, Copper, Bronze, Rubber	Dip tank Squeese rolls Calendered Knife coating	Melt resin in water bath at 120° F. Stir in catalyst without introduction of air						77° / 104°	3 wk. / 1 day in cellophane	Cellophane, polyvinyl alcohol, cellulose acetate. 10% sol'n of PVA in H₂O with Aerosol. Vejin AsC in 98% gasoline	Conventional type	All conventional types	All conventional types	Contact to 100	220	Any thickness	20 min.	195	545													Decorative applications, semi-structural applications.	A non-volatile resin. Shrinkage during cure 8%. Can use special Calco pigments to color resin. Blended with 4116 or 4125 for intermediate properties.
	Melmac 403	Modified melamine-formaldehyde resin	0.47	100		9-9.5	Water, water and alcohol mixtures	Dry resin powder as shipped. / Mixed resin solutionready to apply.	1 yr. / 4 to 8 hr.	Powder B acts as modifier for melamine resin acting as a flux to increase flow of resin	40 to 50	Avoid cast iron		Dipping Brushing Roller coating Glue spreader	Mix 9 parts of powder A to 1 part B. Add to required amount of water with agitation until dissolved	10 to 20 Depends on pressure		Any conventional type	70-80 / 250	3-4 hr. / 3-4 min.	75 or lower	6 wk. to 2 mo.	Carnauba wax, stearates	Any standard equipment	Any standard equipment wood or wax mold. Plaster should be sealed	Any standard equipment	40 to 250	230 to 250	Less than ¼ / ½	20 min. / 45 min.	195	545													Heating ducts, high heat resistance, good dimensional stability.	Resin cures to a yellow to orange color. Darkens with age. Can be pigmented but limited color possibilities. Must provide venting in molds so laminate can breathe.
BAKELITE CORP. 30 E. 42nd ST., NEW YORK 17, N. Y.	BV-16238	Phenolic resin		73-78	1500-2500 at 25° C.	Neutral	Ethyl alcohol, alcohol and water mixtures	Below 70° F. / Below 50° F.	60 days / 6 mo.		27 to 31			Dip tank Roller coating	Thin resin to viscosity desired for treating	4-7		Usually dry in a continuous tunnel dryer	285	5-15 min.	Wrap and protect from moisture and excess temperature	30 days	Any of the conventional mold release agents	All conventional types	All conventional types	All standard types	50 or over	275	¾	10 to 15 min.													Building materials, airplane parts, luggage, furniture.	Shrinkage during cure 8-10%. Limited color possibilities. To obtain high surface finish it is advisable to give a second dip to a liner sheet and build resin content to 40%.
	BV-17035	Phenolic resin		59-64	125-175 at 25° C.	Neutral	Ethyl alcohol, alcohol and water mixtures	Below 70° F. / Below 50° F.	60 days / 6 mo.		27 to 31			Dip tank Roller coating	Thin resin to viscosity desired for treating			Usually dry in a continuous tunnel dryer	285	10 min.	Wrap and protect from moisture and excess temperature	60 days	Any of the conventional mold release agents	All conventional types	All conventional types	All standard types	Contact and up to 100	300	¾	30 to 40 min.													Building materials, airplane parts, luggage, furniture.	Shrinkage during cure 8-10%. Limited color possibilities. To obtain high surface finish it is advisable to give a second dip to a liner sheet and build resin content to 40%.
	BRS-17582	Unsaturated polyester		100	20,500-47,000 at 25° C.	Neutral	None required	70° F.	3 mo.	Modified with styrene monomer	35 to 40	0.5 to 3.0% benzoyl or lauroyl peroxide		Dip tank Roll coating Painting	Add 0.5 to 3.0% benzoyl or lauroyl peroxide and agitate						Wrap in cellophane	24 hr.	Bakelite XK-17561	All conventional types	All conventional types	All conventional types	Contact to 50	290	¾	10 to 15 min.													Automotive applicaions, airplane parts, luggage, decorative panels.	Resin has slight yellow cast. Good color possibilities with pigments.
	BRS-81	Unsaturated polyester		100	900-1550 at 25° C.	Neutral	None required	70° F.	3 mo.	Modified with styrene monomer	35 to 40	0.5 to 3.0% benzoyl or lauroyl peroxide		Dip tank Roll coating Painting	Add 0.5 to 3.0% benzoyl or lauroyl peroxide and agitate						Wrap in cellophane	24 hr.	Bakelite XK-17561	All conventional types	All conventional types	All conventional types	Contact to 50	240	¾	5 to 10 min.													Automotive applications, airplane parts, luggage, decorative panels.	Resin has slight yellow cast. Good color possibilities with pigments.
DUREZ PLASTICS AND CHEMICALS, INC. NORTH TONAWANDA, N. Y.	12108 12120 12668	Phenolic resin	0.175	70 as shipped	25° C. 300-500 can be adjusted	Neutral	Ethyl alcohol	Room temperature / Below 50° F. (as shipped)	1 mo. / 3 mo.		30 to 50			Conventional dip tank	Adjust to desired viscosity and solids content with alcohol	7-9	10-20 (estimate)	Continuous tunnel dryer	Enter at 200. Raise to 250-275	Adjust to give required volatile content	Below 75	Up to 6 mo.	Cellophane, silicone D200	Platen or hat press	Any standard equipment		50-100	340 Heat supplied on one side	0.05 to 0.10	10 to 15 min.	374				0.03	0.055	0.00165	450-600					Shrinkage estimated as 0.5-1.0%. 12108 is olive drab color. 12120 is natural color. 12668 is black color. Resin comes in alcohol solution.
E. I. DU PONT DE NEMOURS & CO., INC. PLASTICS DEPT. 828 SCHUYLER AVE., ARLINGTON, N. J.	BCM	Addition type of polymer	1.25	100	12.3	Neutral	Ketones, alcohols, esters, glycols, aromatic hydrocarbons	No catalyst in dark: 45° F. / 80° F.	Indefinitely / > 3 mo.	Polyvinyl butyral or polybutyl methacrylate increases viscosity of monomer. Styrene improves mechanical properties of laminates. Polymethyl methacrylate (*See Note 1*) Tri-cresyl phosphate Rosin esters	30 to 42	Peroxides 0.1-0.5 by weight ultraviolet light For straight BCM 0.2% lauroyl peroxide	Uncured phenolic resins	Dip tank Squeese rolls Spreading Spray Brush	Add peroxide catalyst	0.21		Forced circulation oven	105-110	20 min.	55-65 no light Room with light	3 mo. / 4 days	Cellophane, cellulose acetate, polyvinyl alcohol	Platen Circulating hot water heated 95° C.	Any material of construction	Forced circulation oven	10-15	203 to 212	With PMMA ⅛ / ¼	10 min. / 20 min.	High load 201 Low load 450	40% PMMA High load 170 Low load > 350	0.02	5.7	0.114	0.017	5.5	0.093	0.04	5.0	0.2	½ in. sample 370	½ in. sample 250		Aviation structures, automotive structures, decorative applications.	At present, this resin is being produced only on an experimental scale. It is available, therefore, only in small trial quantities. For 100% BCM 13.5% shrinkage. Can reduce shrinkage with PMMA. Note 1: Typical formulation is 40 parts PMMA to 60 parts BCM. The PMMA is dissolved in a mutual solvent as acetone.
MARCO CHEMICALS, INC. SEWAREN, N. J.	MR-1A	Allyl type	0.55	100	May be varied between 30 or 40 to 100,000 at 25° C.	Neutral	Ketones, esters, alcohols soluble in chlorinated hydrocarbons	Uncatalyzed rm. temp. / Catalyst rm. temp.	1 yr. / 1 wk.		30 to 50	2-4% benzoyl peroxide	Sulfur bearing compounds	Dip Brush Spray	Add catalyst, stir						Room	2 wk.	Cellophane, PVA	Any standard equipment	Any standard equipment	Any standard equipment	Contact	Start at 158. Raise to 248 slowly	¼ / ¾	2-4 hr. / 4-8 hr.		320	0.005	3.52	0.0176	0.0045	3.46	0.0156	0.0156	3.36	0.051				Applications requiring high temp. stability, marine building materials, floor tile, automotive panels, flexible and rigid wall coverings.	Colored objects can be produced.
	MR-17A	Unsaturated polyester	0.55	100	120,000 at 40° C. Can adjust with modifier	Slightly acid	Ketones, esters, alcohols soluble in chlorinated hydrocarbons	Uncatalyzed 70° F. / Refrigerated. / Catalyst rm. temp.	3 mo. / > 3 mo. / 1 wk.	Modifier A Dissolve catalyst, then mix with resin	Avg. 50	1-2% benzoyl peroxide	Synthetic rubber. Adsorptive mat'ls leach out catalyst. Air somewhat inhibiting Sulfur bearing compounds	Dip tank Spray Brush Knife coating	Heat monomer to 40° C by hot water bath. Add catalyst to resin with stirring						40	2 wk.	Cellophane, Marco separating compounds	Any standard equipment	Wood, plaster, aluminum, steel	Circulating air. Infrared	Contact	320	1½	5-10 min.	275	345	0.011	3.70	0.0406	0.0068	3.60	0.0352	0.0308	3.36	0.07				Shingling material, electrical parts, luggage, aircraft, marine building materials, floor tile, automotive panels, flexible and rigid wall coverings.	Shrinkage 8-10% during cure. Clear. Higher temp. stability and greater chemical resistance in laminate than other resins of this series.
	MR-17C	Unsaturated polyester	0.45	100	120,000 at 40° C. Can adjust with modifier. Adjustable to water consistency	Slightly acid	Ketones, esters, alcohols soluble in chlorinated hydrocarbons	No catalyst 70° F. / With catalyst rm. temp.	3 mo. / 1 wk.	Modifier C or styrene Dissolve catalyst, then mix with resin prior to use	Avg. 50	1-2% benzoyl peroxide	Synthetic rubber. Adsorptive mat'ls leach out catalyst. Air somewhat inhibiting Sulfur bearing compounds	Dip tank Spray Brush Knife coating	Dissolve 1.2 gm. benzoyl peroxide in 22 gm. of MR-17C solvent. Add to 100 gm. of resin						40	2 wk.	Cellophane, Marco separating compounds	Any standard equipment	Wood, plaster, aluminum, steel. Bag mold is practical	Circulating hot air. Infrared	Contact	280	0.03	10 min.	275	345	0.011	3.70	0.0406	0.008	3.60	0.0352	0.308	3.36	0.07				Electrical parts, luggage, aircraft, marine building materials, floor tile, automotive panels, flexible and rigid wall coverings.	Shrinkage 8-10% during cure. Clear and colorless. General purpose resin.
	MR-21A	Unsaturated polyester	0.55	100	60,000 Can be adjusted with modifier	Very slightly acid	Ketones, esters, alcohols soluble in chlorinated hydrocarbons	Uncatalyzed 70° F. / Catalyzed	3 mo. / 1-2 days	Modifier A Dissolve catalyst, then mix with resin	Avg. 50	1-2% benzoyl peroxide	Synthetic rubber. Adsorptive mat'ls leach out catalyst. Air somewhat inhibiting Sulfur bearing compounds	Dip tank Spray Brush Knife coating	Dissolve catalyst in modifier, then mix with resin						40	1 wk.	Cellophane, polyvinyl alcohol, Marco separating compounds	Any standard equipment	Wood, plaster, aluminum, steel. Bag mold is practical	Circulating air. Infrared	Contact	280	½	5-10 min.												Applications requiring high temp. stability or good chemical resistance, marine building materials, floor tile, aircraft.	A resin of balanced properties particularly well adapted for the production of rigid laminates highly resistant to acids, alkalies, and organic solvents. Shrinkage 8% during cure.
	MR-21C	Unsaturated polyester	0.45	100	35,000 to 40,000. Can adjust with modifier	Very slightly acid	Ketones, esters, alcohols soluble in chlorinated hydrocarbons	Uncatalyzed 70° F. / Catalyzed	3 mo. / 2-3 days	Modifier C or styrene. Dissolve catalyst, then mix with resin	Avg. 50	1-2% benzoyl peroxide	Synthetic rubber. Adsorptive mat'ls leach out catalyst. Air somewhat inhibiting. Sulfur bearing compounds	Dip tank Spray Brush Knife coating	Dissolve catalyst in modifier, then mix with resin						40	1 wk.	Cellophane, polyvinyl alcohol, Marco separating compounds	Any standard equipment	Wood, plaster, aluminum, steel. Bag mold is practical	Circulating air. Infrared	Contact	280	¾	5-10 min.					0.0061	3.83		0.015	3.16				Electrical parts, luggage, aircraft, boat hulls, automobile panels, rigid wall coverings, phosphorescent laminates, casting and moldings, decorative applications.	A versatile resin with excellent fabricating properties and characterized by exceptional interlaminating adhesion, outstanding weather and chemical resistance. Shrinkage 8% during cure.
	MR-21D	Unsaturated polyester	0.45	100	40,000 at at 40° C. Can adjust with modifier	Very slightly acid	Ketones, esters, alcohols soluble in chlorinated hydrocarbons	No catalyst 70° F. / Refrigerated. / Catalyst rm. temp.	3 mo. / 3 mo. / 1 wk.	Modifier C or styrene. Dissolve catalyst, then mix with resin prior to use	Avg. 50	1-2% benzoyl peroxide	Synthetic rubber. Adsorptive mat'ls leach out catalyst. Air somewhat inhibiting. Sulfur bearing compounds	Dip tank Spray Brush Knife coating	Dissolve 1.2 gm. benzoyl peroxide in 22 gm. MR-17D solvent. Add to 100 gm. of resin						40	2 wk.	Cellophane, Marco separating compounds	Any standard equipment	Wood, plaster, aluminum, steel. Bag mold is practical	Circulating air. Infrared	Contact	280	0.03	10 min.	275	345			0.0061	3.83		0.015	3.16				Shingling material, electrical parts, luggage, aircraft, marine building materials, floor tile, automotive panels, flexible and rigid wall coverings.	Shrinkage 6-7% during cure. Opaque white. Self-extinguishing by A.S.T.M. D 635-44.
	MR-22	Unsaturated polyester	0.50	100	8,000 to 9,000. Can adjust with modifier	Very slightly acid	Ketones, esters, alcohols soluble in chlorinated hydrocarbons	Uncatalyzed 70° F. / Catalyzed	3 mo. / 1-2 days	Modifier C, styrene, other MR-resins. Dissolve catalyst then mix with resin	Avg. 50	1-2% benzoyl peroxide	Synthetic rubber. Adsorptive mat'ls leach out catalyst. Air somewhat inhibiting. Sulfur bearing compounds	Dip tank Spray Brush Knife coating	Dissolve catalyst in modifier, then mix with resin						40	3-5 days	Cellophane, polyvinyl alcohol, Marco separating compounds	Any standard equipment	Wood, plaster, aluminum, steel. Bag mold is practical	Circulating air. Infrared	Contact	280	¾	10-15 min.												Flexible applications, lamp shades, flexible and semi-flexible wall coverings, synthetic leathers, shower curtains.	A resin primarily used for the production of flexible laminates which are unaffected by temperature changes and are inert to acids and alkalies.
	MR-23	Unsaturated polyester	0.50	100	10,000 to 12,000. Can adjust with modifier	Very slightly acid	Ketones, esters, alcohols soluble in chlorinated hydrocarbons	Uncatalyzed 70° F. / Catalyzed	3 mo. / 1-2 days	Modifier C, styrene, other MR-resins. Dissolve catalyst, then mix with resin	Avg. 50	1-3% benzoyl peroxide	Synthetic rubber. Sulfur compounds. Adsorptive mat'ls leach out catalyst. Not inhibited by air	Dip tank Spray Brush Knife coating	Dissolve catalyst in modifier, then mix with resin						40	3-5 days	Cellophane, polyvinyl alcohol, Marco separating compounds	Any standard equipment	Wood, plaster, aluminum, steel. Bag mold is practical	Circulating air. Infrared	Contact	280	¾	10-15 min.					0.014	4.50		0.034	4.14				Flexible, air drying applications, lamp shades, synthetic leathers, flexible wall coverings, shower curtains.	A flexible thermosetting resin which is not inhibited by air.
	MR-24C	Unsaturated polyester	0.50	100	10,000 to 12,000. Can adjust with modifier	Slightly acid	Ketones, esters, alcohols soluble in chlorinated hydrocarbons	Uncatalyzed 70° F. / Catalyzed	3 mo. / 2-3 days	Modifier C or styrene. Dissolve catalyst, then mix with resin	Avg. 50	1-2% benzoyl peroxide	Synthetic rubber. Sulfur compounds. Adsorptive mat'ls leach out catalyst. Not inhibited by air	Dip tank Spray Brush Knife coating	Dissolve catalyst in modifier, then mix with resin						40	1 wk.	Cellophane, polyvinyl alcohol, Marco separating compounds	Any standard equipment	Wood, plaster, aluminum, steel. Bag mold is practical	Circulating air. Infrared	Contact	280	½	5-10 min.												Bonding agent for light weight spongy fillers, impregnating porous materials such as plaster, paper pulp.	A non-air-inhibited resin of special interest in the coating field. Shrinkage 8% during cure.
	MR-25C	Unsaturated polyester	0.50	100	10,000 to 12,000. Can adjust with modifier	Slightly acid	Ketones, esters, alcohols soluble in chlorinated hydrocarbons	Uncatalyzed 70° F. / Catalyzed	3 mo. / 2-3 days	Modifier C or styrene. Dissolve catalyst, then mix with resin	Avg. 50	1-2% benzoyl peroxide	Synthetic rubber. Sulfur compounds. Adsorptive mat'ls leach out catalyst. Not inhibited by air	Dip tank Spray Brush Knife coating	Dissolve catalyst in modifier, then mix with resin						40	1 wk.	Cellophane, polyvinyl alcohol, Marco separating compounds	Any standard equipment	Wood, plaster, aluminum, steel. Bag mold is practical	Circulating air. Infrared	Contact	280	½	5-10 min.					0.007	3.24		0.014	3.10				Pottery glaze, luting cements, chemical equipment, special coating and adhesive applications.	A non-air-inhibited resin of special interest in the adhesive and coating fields. Shrinkage 6-8% during cure.

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(See Also Laminating Chart — 10-b)

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PLASTICS IDENTIFICATION CHART - 1947

PLASTICS IDENTIFICATION 1

TABLE I.—BURNING CHARACTERISTICS OF ORGANIC PLASTIC MATERIALS

TYPE	EASE OF IGNITION	SELF-EXTINGUISHING	CHARACTER OF FLAME	BEHAVIOR OF MATERIAL	ODOR
Acrylic	Readily	No	Yellow, blue around bottom edges, some black smoke; spurts	Softens; usually no drip; very little char left after flame is blown out	Characteristic of acrylic monomers
Allyl ester	Moderate	No	Yellow, blue edges, black smoke	Cracks and pieces fall off; fallen pieces continue to burn; turns yellow, small amount of melted material at edges of burned area	Characteristic
Aniline-formaldehyde	Readily	Yes	Yellow, large spurts, black smoke	Swells; softens	Characteristic; formaldehyde
Butadiene copolymer rubber	Readily	No	Dark yellow, smoky, clumps of carbon in air	Softens	Characteristic
Butyl rubber	Readily	No	Yellow, black smoke	Softens, cracks	Characteristic
Casein	Moderate	Yes	Yellow, gray smoke	Swells; chars	Burning protein materials, such as wool, milk curds, silk, etc.
Cellulose acetate	Readily	No	Dark yellow, some black smoke	Melts, drips; drippings continue to burn	Characteristic
Cellulose acetate butyrate	Readily	No	Dark yellow with slight blue edge; some black smoke	Melts, drips; drippings continue to burn	Characteristic; butyric acid
Cellulose acetate propionate	Readily	No	Dark yellow, some black smoke	Melts, drips; dripping continue to burn	Characteristic; propionic acid
Cellulose nitrate	Very readily	No, burns extremely fast	Yellow; very hot	Material burns completely	Burns too fast to detect
Cold molded	Moderate	No	Dark yellow, may give off black smoke	Softens	Bituminous; waxy odor
Ethyl cellulose	Readily	No	Yellow, blue edges	Melts, drips; drippings continue to burn	Characteristic; resembles cellulose acetate except LT composition which resembles burning oil and wax
Factice	Readily	Yes, slow	Blue flame	Melts	Characteristic
Lignin, laminated paper	Moderate	No	Dark yellow, black smoke, light purple edge on flame	Swells; cracks between laminae; softens	Resembles burning wood
Lignocellulose	Moderate to difficult	Yes	Yellow, purplish-blue around bottom; spurts	Swells; cracks	Resembles burning wood, may be slightly sweet
Melamine-formaldehyde	Difficult	Yes	Light yellow	Swells; cracks; turns white at edges of burned section	Characteristic, resembles urea; ammonia and formaldehyde present
Neoprene	Readily	Yes, slow	Orange-yellow, black smoke, small green section around bottom	Softens, char remains	Characteristic, slight resemblance to natural rubber, sharp component present
Nylon	Moderate	Yes	Blue with yellow top	Melts, drips and froths	Characteristic
Phenolic, cast	Difficult	Yes	Yellow, sparks	Cracks badly and deeply	Phenolic, strong with formaldehyde
Phenolic, impregnated wood	Moderate	Yes, but continues to burn for a few minutes on removal from flame	Yellow	Swells; cracks	Wood; phenolic
Phenolic, laminated, fabric-base	Moderate	No	Yellow, a little black smoke	Swells; cracks between laminae	Fabric; phenolic
Phenolic, laminated, paper-base	Moderate	No	Yellow, a little back smoke	Swells; cracks between laminae	Paper, phenolic
Phenolic, molded, filler	Difficult	Yes	Yellow	Swells; cracks	Phenolic; odor from resin may be temporarily masked by odor from decomposing organic fillers such as woodflour
Phenolic, molded, no filler	Very difficult	Yes	Yellow, sparks less than cast	Cracks	Phenolic
Polyethylene	Readily	No	Bottom blue, top yellow	Melts and drips	Burning paraffin
Polystyrene	Readily	No	Orange-yellow, black dense smoke, large clumps of carbon in air	Softens	Characteristic of styrene monomer
Polytetrafluoroethylene	Will not ignite in bunsen flame	—	—	—	—
Rubber, hard, natural	Readily	No	Orange-yellow; black smoke; spurts or shoots of light yellow flame	Swells; material does not soften, but liquid comes to surface	Characteristic
Rubber, natural	Readily	No	Dark yellow; black smoke	Softens	Characteristic
Shellac	Easily	No	Orange-yellow; blue around bottom edge; black smoke; a few blue-light yellow spurts	Softens	Characteristic (sealing wax)
Urea-formaldehyde	Difficult	Yes	Pale yellow with light greenish-blue edge	Swells; cracks; turns white at edges of burned section	Characteristic; urea; strong with formaldehyde
Vinyl acetate	Readily	No	Dark yellow flame; spurts, black smoke; clumps of carbon smaller than that from polystyrene	Softens	Characteristic; resembles other vinyls except for absence of chlorine; resembles polystyrene
Vinyl butyral	Readily	No	Bottom blue, top yellow	Melts and drips; drippings usually do not continue to burn	Characteristic; resembles vinyl and butyric acid
Vinyl chloride	Difficult	Yes	Yellow, green on bottom edges; spurts green and yellow, white smoke	Softens	Characteristic; chlorine
Vinyl chloride-acetate	Difficult	Yes	Dark yellow, smoky	Softens	Characteristic; chlorine detectable
Vinylidene chloride	Very difficult	Yes	Yellow, green on edges; spurts green	Softens	Characteristic; chlorine
Vulcanized fibre	Moderate	No	Light yellow, purple edges	Swells at edges, splits on laminae, smolders	Burning hay or grass

TABLE II.—SOLUBILITY OF VARIOUS ORGANIC PLASTICS IN ORGANIC LIQUIDS

PLASTIC \ SOLVENT	ETHYL ALCOHOL, 95%	n-BUTYL ALCOHOL	METHYL ACETATE	ETHYL ACETATE, 12% ETHYL ALCOHOL	n-BUTYL ACETATE	ETHYL ETHER	DIOXANE	CELLOSOLVE	ETHYLENE GLYCOL	ETHYLENE DICHLORIDE	CHLOROFORM	TOLUENE	ACETONE	NITROETHANE	PYRIDINE	ACETIC ACID
Cellulose acetate butyrate	I	I	S	S	PS	I	S	PS	I	S	S	I	S	S	S	S
Cellulose acetate, high acetyl	I	I	PS	I	I	I	S	I	PS	PS	I	I	S	PS-I	S-PS	PS
Cellulose acetate, partially hydrolyzed	I	I	S	PS	I	I	S	I	PS-I	I	I	I	S	S	S	S
Cellulose acetate propionate	I	I	S	S	S	I	S	S	I	I	S	I	S	S	S	S
Cellulose nitrate	I	I	S	S	S	S	S	S	PS-I	I	PS-I	I	S	S	S	S
Ethyl cellulose, 45.0–46.5% ethoxy	PS	PS	S	S	PS	PS	S	PS	I	S	S	PS	PS	S	S	S
Ethyl cellulose, 48.5–49.5% ethoxy	S	S	S	S	S	PS	S	S	I	S	S	S	S	S	S	S
Methyl methacrylate	I	I	S	S	S	S	S	S	I	S	S	S	S	S	S	S
Styrene	I	I	S	S	S	S	S	I	I	S	S	S	PS	S	S	I
Vinyl acetate	S	S	S	S-PS	S	PS	S	S	I	S	S	S	S	S	S	S
Vinyl alcohol, completely hydrolyzed	I	I	I	I	I	..	..	..	PS	I	S	I	I	I	..	..
Vinyl butyral, 11% hydroxyl	S	S	S	S	S	PS	S	S	I	S	S	S	S	I	S	S
Vinyl butyral, 19% butyral	S	S	PS	PS	PS	PS	S	S	I	PS	S	PS	PS	I	S	S
Vinyl chloride	I	I	I	I	I	I	S	I	I	S	..	I	PS	I	PS-I	I
Vinyl chloride acetate, 85–91% vinyl chloride	I	I	S	S	S	I	S	I	I	S	..	I	S	S	S	I
Vinyl chloride acetate, 93–95% vinyl chloride	I	I	I	I	I	I	S	I	I	S	..	I	PS	I	..	I
Vinylidene chloride, type B115	I	I	I	I	I	I	PS	I	I	I	I	I	I	I	I	I
Vinylidene chloride, type F120	I	I	PS	I	PS	I	S	I	I	PS	I	I	PS	S	I	I

S-soluble. PS-partially soluble. I-insoluble.

TABLE III.—CHEMICAL COLOR IDENTIFICATION TESTS ON PLASTICS

NAME OF TEST	PROCEDURE	COLOR DEVELOPED	TYPE OF PLASTIC
Aniline	Heat a small piece of the plastic with 20% sulfuric acid. Diazotize solution and couple with R-salt	Bright red	Aniline-formaldehyde
Antimony pentachloride	The reagent is made by dissolving 20 ml. antimony pentachloride (not contaminated with free chlorine) in 80 ml. chloroform. Four drops of a solution of the resin are placed on a watch glass and 1–2 drops of the reagent added. After 5 min., observe color. Then add 10 ml. chloroform and observe color	Blue black sludge, deep blue solution Purple black sludge, faint purple black solution Purple sludge, dirty wine solution — Brown sludge, red brown solution Purple sludge, blackish purple solution Purple black sludge, faint black solution Purple brown sludge, brown solution Red brown sludge, orange solution — Pink brown sludge, pink solution	Limed rosin Glycerol rosin ester Glycerol rosin-maleic ester Glycerol polymerized rosin maleic ester Glycerol rosin-maleic ester, phenol modified Pentaerythritol rosin ester Pentaerythritol rosin-maleic ester Pentaerythritol rosin ester, phenol modified *p*-Phenylphenol resin *p*-*tert*-Butylphenol resin Coumarone
Carbazole	Heat to boiling a small piece of the plastic with 5 ml. of either 5% sulfuric acid or 5% sodium hydroxide. Cool and add a 0.1% solution of carbazole in sulfuric acid dropwise	Deep blue	Urea formaldehyde or any resin which will give formaldehyde on hydrolysis by acid or alkali
Colliton Fast Yellow RRA dye	Immerse a piece of colorless plastic in a 0.1% solution of Colliton Fast Yellow RRA dye at 70° C. for 30 min., remove and rinse with water. Then immerse in 0.1% soap solution at 40° C. for 2 hr. Particularly useful for finishes on fabrics	Deep yellow	Vinyl, acrylic, cellulose acetate
	To distinguish cellulose acetate from the vinyl and acrylic resins, treat the dyed sample with 10 ml. of toluene and 1 drop of iodine-potassium iodide starch indicator solution	Yellow Pink	Vinyl, acrylic Cellulose acetate
Cellulose ether dye	Place a piece of the plastic in a 0.5% solution of Niagara Sky Blue 6B or Solantine Blue 4GL dye for 1 min. and stir constantly. Then remove, rinse with water at 40° C. and dry. This may be done under a microscope with 0.05% dye solution. Particularly useful for finishes on fabrics.	Deep blue	Ethyl cellulose, methyl cellulose
Coumarone	Dilute 1 ml. of a 10% solution of plastic in chloroform to 6 ml. with chloroform and add 1 ml. of concentrated acetic acid. Mix and add 1 ml. of 10% solution of bromine in chloroform. Mix and allow to stand	Red, permanent	Coumarone, coumarone-indene
Diphenylamine	Shavings from the plastic piece are immersed in a colorless solution consisting of 0.017 gram of diphenylamine dissolved in 30 ml. of water and 100 ml. of concentrated sulfuric acid. Test preferably made on a porcelain spot plate	A full deep blue color develops around the pieces of plastic in about 2 minutes	Cellulose nitrate; oxidizing agents interfere
Fuchsin	Heat plastic with 25% sulfuric acid vapors in water. To 2 ml. of fuchsin aldehyde reagent add 2 drops of the water solution. Reagent is made by dissolving 0.2 g. of fuchsin in 100 ml. hot water, cooling, adding 2 g. sodium bisulfite, 2 ml. concentrated nitric acid and diluting to 200 ml.	Reddish purple	Aldehyde is a component
Hirschsohn reagent	The reagent is made by dissolving 9 grams of trichloroacetic acid in 1 ml. of distilled water. Place a small piece of the resinous material on a porcelain spot plate and add 3–4 drops of the reagent. Since the color develops slowly at 20° C. or less, the reaction may be accelerated by warming the spot plate to 35° C.	Blue green in 1 to 2 min., dark blue in 5 min. Red in 1 to 2 min., purple in 5 min. Bright red in 1 to 2 min. Light red in 1 to 2 min. Light blue green in 1 to 2 min. Dark red in 1 to 2 min. Brown in 1 to 2 min., purple in 5 min. Brown in 1 to 2 min., brown red in 5 min. Light yellow in 1 to 2 min. Practically no color	Rosin Ester gum Cyclohexanone-formaldehyde Coumarone Hydrogenated rosin Tung oil ester gum Perilla ester gum Linseed oil varnish film Dehydrated castor oil varnish film Tung oil varnish film
Indophenol	Test made with sodium hydroxide fusion residue or with destructive distillation products in aqueous solution. Two to three drops of 1% aqueous dibromoquinone chlorimide is added to 10 ml. of aqueous solution. Add 0.1 *N* sodium hydroxide dropwise to pH of about 9.4	Blue to wine Purple-blue	Phenol, cresols, and xylenols *p*-*tert*-Butylphenol and *p*-*tert*-amylphenol
Lignin-aniline	To 0.4 g. of plastic in a test tube add 5 ml. 3 *M* hydrochloric acid and boil for 1 minute. Put a 2-in. long cylindrical roll of filter paper which has been freshly impregnated with aniline acetate halfway into the tube and then boil for another minute. Observe color on the paper	Pink	Lignin and many carbohydrates
Millon's reagent	The reagent is made by dissolving metallic mercury in concentrated nitric acid and diluting with an equal volume of water. Two drops of reagent are added to aqueous solution of destructive distillation of plastic. Mix and heat to boiling	Deep red to brown Lavender to purple Rose	Phenol, cresols, and xylenols *p*-Phenylphenol *p*-*tert*-Butylphenol and *p*-*tert*-amylphenol
Molisch carbohydrate	To 5 mg. of the resin in a test tube add 10 drops of water if the resin is water-soluble or 95% ethanol if the resin is water-insoluble and 2 drops of a 10% solution of α-naphthol in chloroform. Then add 1 ml. of sulfuric acid slowly so that two separate layers of liquid are produced. Observe color of ring at interface. Then mix and observe color again. Next add 5 ml. water and observe color of precipitate. Then add an excess of ammonium hydroxide and observe color	Red ring at interface, dark purple solution on mixing; dull violet precipitate and reddish yellow-brown on addition of the ammonia	Cellulosic materials, such as cellulose derivatives, starches, sugars, gums and glycoproteins
Phenolphthalein	One gram of plastic is heated with 3 grams of phenol and 5 drops of concentrated sulfuric acid until the melt is brownish orange. Extract the cooled melt with boiling water and make alkaline	Red, color of alkaline phenolphthaleio	Phthalates
	Repeat the test as described except use 1 gram of phthalic anhydride in place of the phenol	Red, color of alkaline phenolphthalein	Phenolic
Resorcinol	0.5 to 1 gram of the plastic is heated with 2 to 3 grams of resorcinol to the boiling point of the latter. The cooled melt is extracted with boiling water and made alkaline	Greenish-yellow fluorescence of fluorescein	Phthalates; other dibasic acids may interfere
Uranium nitrate	A piece of the plastic is dissolved in chloroform or carbon tetrachloride and a small portion of the solution placed on a spot plate. An equal volume of a saturated solution of uranium nitrate in ether is added and the solutions mixed. A few drops of concentrated ammonium hydroxide are added after a few seconds. Color develops instantaneously if phenolic resins are present	Deep reddish brown, clear smooth appearance Yellow to coffee-brown, curdy appearance Pale straw	Phenolic, unmodified[b] Phenolic, modified[b] All types other than phenolic
Liebermann-Storch-Morawski	Dissolve a small piece of the plastic in hot acetic acid anhydride, cool, and add 1 drop of sulfuric acid to the solution on a porcelain spot plate. Observe for one-half hour. Note the colors in order of their formation		

COLOR DEVELOPED	TYPE OF PLASTIC
Yellow, slowly	Vinylidene chloride
Yellow to olive, slowly	Methyl cellulose
Yellow to red to red brown	Phenolic
Yellow to dark brown	Vinyl butyral
Orange, light	Hydrogenated coumarone
Orange, dark	Rosin acid
Orange to brick red	Coumarone
Orange to red brown to dark brown	Vinyl acetal, vinyl butyral
Orange to light brown, slowly	Benzyl cellulose
Orange to brown to black	Ethyl cellulose
Orange to dark brown	Vinyl acetal
Red, bright	Indene
Red to rose	Ketone
Red to red brown to brown	Vinyl acetal butyral
Red to purplish red to green	Coumarone
Red to purplish red to brown	Coumarone
Red to brown red to dark brown	Phenol and oil modified alkyd
Red to violet to green to blue	Rosin derivative
Red to violet to blue to black	Rosin derivative
Red to violet to purple to green	Rosin derivative
Red to violet to brown	Maleic esters[a]
Red to green	Pentaerythritol esters
Rose, weak	Benzyl cellulose
Rose	Coumarone, ethyl cellulose
Scarlet to red brown to brown	Phenol-indene-coumarone
Scarlet to red violet	Coumarone
Red violet (pale) to brown to dark red brown	Alkyl polysulfide
Red violet to brown	Rosin modified alkyd
Red brown	Chloroprene, aldehyde, sulfonamide
Red brown to orange	Phenolic
Red brown to dark brown	Cashew nut oil
Bistre, slowly	Vinyl formal
Brown, light, slowly	Methyl acrylate
Brown, light	High acetyl cellulose acetate
Brown, light, to red brown	Vinyl alcohol
Brown to light green	Vinyl alcohol acetate
Brown to dark brown	Oil-modified alkyd
Green, light, slowly	Vinyl formal
Green, slowly	Vinyl acetate, copolymer of vinyl acetate with fumarates and maleates
Green to blue to brown, slowly	Vinyl chloride acetate
Blue, slowly	Vinyl chloride
Blue, pale, to gray green	Butadiene-styrene
Violet to brown to red brown to muddy green	Phenolic
Violet to brown to black	Modified rosin
A dark reddish brown pungent gas evolved, nitrogen dioxide	Cellulose nitrate

[a]Resins made with both maleic anhydride and pentaerythritol give the color reaction typical of pentaerythritol esters.
[b]Not applicable to phenolics which are insoluble in chloroform or carbon tetrachloride; applies mostly to coatings and uncured resins.

TABLE IV.—MICROSCOPIC STAINING TESTS ON PLASTICS

STAINING REAGENT	PROCEDURE	RESULTS
Ammonia and bromine	Wet section with water, hold in ammonia vapors and then in bromine gas; blot and mount in oil	Cured phenolics stain red to yellow. Uncured resin and cellulose fibers unaffected
Calcocid Alizarine Blue S. A. P. G.	Section immersed in a 0.1% solution of Calcocid Alizarine Blue S. A. P. G. containing 0.1% sulfuric acid	Urea-formaldehyde and melamine-formaldehyde resins and proteins turn blue. Procedures are given in reference 10, p. 720, for distinguishing among these 3 materials with this dye. Cellulosic fibers unaffected
Dispersol Fast Red L. G. G.	Section immersed in a 1% alcoholic solution of Dispersol Fast Red L. G. G.	Thermoplastics such as polystyrene, polyvinyl formal and polyacrylates stain red in a few minutes. Cellulosic fibers unaffected. Phenolic resins, particularly oil-modified, stain red after 6 hours. Urea-formaldehyde resin stains red
Kiton Blue V	Section immersed overnight in solution of Kiton Blue V buffered to a pH of 3.1	Urea-formaldehyde resin and lignified cellulose (kraft paper or wood) stain blue. Cellulosic fibers and phenolic resins unaffected
Methyl red	Section immersed 1–6 hr. in a saturated aqueous solution of methyl red	Uncured phenolic resins stain scarlet; cellulosic fibers pink. Cured phenolic resin unaffected
Neutral red chloride	Sections immersed overnight in a saturated alcoholic solution of neutral red chloride which is made yellow by adding sodium hydroxide, then washed in water which is slightly acidic	Cured phenolic resins stain red to scarlet with increase of polymerization. Uncured resin dissolves. Cellulosic fibers unaffected
Phloroglucinol	Powdered molding material is treated with a solution of phloroglucinol in 20% hydrochloric acid and examined under a microscope	Woodflour stains red
p-Phenylenediamine	Section immersed 1 hr. in a saturated solution of *p*-phenylenediamine, then 15 min. in hydrogen peroxide	Uncured phenolic resins stain black; cellulosic fibers mauve to brown. Cured phenolic resin unaffected. Urea-formaldehyde resin stains mauve. Thermoplastics stain yellow

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LOW PRESSURE LAMINATING RESINS CHART - 1947

Manufacturer	Resin: Company number	Resin: Identity	Price: Price/lb./ carload f.o.b.	Physical characteristics of uncured resin: Solids	Viscosity	pH	Solvents	Storage: Conditions	Storage: Life	Modifications
HERCULES POWDER CO., INC. WILMINGTON, DELAWARE		Cellulose acetate	0.42	20% for treating Shipped as 100% solids	Depends on resin formulation. Varied at will	Neutral	90:10 mixture of acetone: alcohol		Stable indefinitely	Any plasticizer used with resin in molding powder can be used for lamination
		Ethyl cellulose	0.57 for 5000 lb. or more	20% for treating Shipped as 100% solids	Depends on resin formulation. Varied at will	Neutral	Ethyl acetate		Stable indefinitely	Any plasticizer used with resin in molding powder can be used for lamination
MONSANTO CHEMICAL CO., PLASTICS DIV. SPRINGFIELD, 2, MASS.	Thalid X-626	Polyester	0.45 for 20,000 lbs.	100	1,000	Neutral	Ethyl acetate, dioxane, benzene, ethylene dichloride, low molecular weight chlorinated hydrocarbons	No catalyst 77° F.	2 mo.	
	Thalid X-526-10	Polyester	0.45	100	1,000	Neutral	Ethyl acetate, dioxane, benzene, ethylene dichloride, low molecular weight chlorinated hydrocarbons	No catalyst 77° F.	2 mo.	
	Thalid X-536	Polyester	0.56	100	90,000 to 150,000	Neutral	Ethyl acetate, dioxane, benzene, ethylene dichloride, low molecular weight chlorinated hydrocarbons	No catalyst 77° F.	2 mo.	
	Thalid X-641-10	Polyester	0.53	100	1,000	Neutral	Ethyl acetate, dioxane, benzene, ethylene dichloride, low molecular weight chlorinated hydrocarbons	No catalyst 77° F.	2 mo.	
	Thalid X-651-10	Polyester	0.45	100	1,000	Neutral	Ethyl acetate, dioxane, benzene, ethylene, dichloride, low molecular weight chlorinated hydrocarbons	No catalyst 77° F.	2 mo.	
PITTSBURGH PLATE GLASS CO., COLUMBIA CHEMICAL DIV. FIFTH AVE., AT BELLEFIELD, PITTSBURGH 13, PA.	Allyl diglycol carbonate (Allymer CR-39)	Allyl resin	0.50 to 0.55	100	25° C.- 19.5 70° C.- 6.4	Neutral	Alcohol, acetone, ethyl acetate, acetic acid, other	No catalyst With catalyst	Several months Approx. 3 wk.	Vinyl acetate or methyl methacrylate increase thermo-elasticity Polyvinyl acetate or nitrocellulose slight softening Rezyl 19—good extender
PITTSBURGH PLATE GLASS CO., PAINT DIV. MILWAUKEE, WIS.	Selectron 5000 Series	Addition-type copolymer		100	25 to 25,000 at 25° C., adjustable	Slightly acid	Amyl acetate, acetone, benzene, ethylene dichloride	Uncatalyzed: 40° F. 77° F. 150° F. Catalyzed: 77° F. Away from sun	Indefinitely 4-6 mo. Up to 10 days 14 hr.- 3 days	Add a member of Selectron 5200 Series to increase flexibility. Special Selectron 5900 Series modifiers available
	Selectron 5200 Series	Addition-type copolymer		100	50 to 1,000 at 25° C., adjustable	Slightly acid	Amyl acetate, acetone, benzene, ethylene dichloride	Uncatalyzed: 40° F. 77° F. 150° F. Catalyzed: 77° F. Away from sun	Indefinitely 4-6 mo. Up to 10 days 14 hr.- 3 days	Selectron 5901 modifier reduces air sensitivity
	Selectron 5400 Series	Addition-type copolymer		100	Paste at 25° C.	Slightly acid	Methyl ethyl ketone, ethylene dichloride, diethyl acetate, benzene. As solvents at 130° F.	Uncatalyzed: 40° F. 77° F. 150° F. Away from sunlight Catalyzed: 77° F.	Indefinitely 4-6 mo. Up to 10 days 14 hr.- 3 days	Add plasticizing resin, Selectron 5200 Series, to improve flexibility Selectron S-5901 helps cure in air
PLASKON DIV., LIBBEY-OWENS-FORD GLASS CO. 2112-24 SYLVAN AVE., TOLEDO 6, OHIO	Plaskon 911	Copolymer based on unsaturated polyester	0.55	100	Room temp., 170,000	Slightly acid	Acetone, ethyl acetate and higher esters, cellosolves	Before mixing and catalyzing. Catalyzed 70-80° F.	Stable indefinitely 24 hr.	All modifiers are included in resin as shipped
	Plaskon 930	Copolymer based on unsaturated polyester	0.58	100	Room temp., 25,000	Slightly acid	Acetone, ethyl acetate and higher esters, cellosolves	Before mixing and catalyzing Catalyzed 70-80° F.	Stable indefinitely 24 hr.	All modifiers are included in resin as shipped
	Plaskon 960	Copolymer based on unsaturated polyester	0.485	100	Room temp., 5,000	Slightly acid	Acetone, ethyl acetate and higher esters, cellosolves	Before mixing and catalyzing Catalyzed 70-80° F.	Stable indefinitely 24 hr.	All modifiers are included in resin as shipped
REICHHOLD CHEMICALS, INC. 801 WOODWARD HEIGHTS BLVD., DETROIT 20, MICH.	Plyophen 5013	Straight phenolic resin	0.1475	60	40-75 at 25° C.	Mildly alkaline	Alcohol, acetone, compatible with a limited amount of water	As shipped set up to 80° F.	2 mo.	Extended with lignin or Vinsol up to 25% without materially affecting the properties
	Paraplex P-10	Polyester resin		100	400 to 600 at 25° C.	Neutral	Aromatic hydrocarbons and chlorinated hydrocarbons, can dilute with limited amount of esters, ketones	Absence of light, room temp., no catalyst With catalyst in closed container	12 mo. 4-7 days	Monomeric styrene and some rigid resins improve strength and rigidity
RESINOUS PRODUCTS AND CHEMICAL CO., INC. WASHINGTON SQUARE, PHILADELPHIA 5, PA.	Paraplex P-13	Polyester resin	0.48	100	250 to 370	Neutral	Aromatic hydrocarbons and chlorinated hydrocarbons	Absence of light, room temp. no catalyst With catalyst in closed container	12 mo. 4-7 days	Monomeric styrene and diallyl phthalate. Ethyl acrylate for greater flexibility
	Paraplex AP-43	Polyester resin	0.46	100	7500	Slightly acid	Small amounts of chlorinated hydrocarbons and certain other strong solvents	Absence of light, room temp., no catalyst With catalyst in closed container	6 mo. 14 days	Monomeric styrene or diallyl phthalate. May be blended with Paraplex AP-43 for greater toughness
U. S. RUBBER CO. NAUGATUCK CHEMICAL DIV. 1230 AVENUE OF THE AMERICAS, NEW YORK 20, N. Y.	Vibrin 103	Unsaturated polyester with cross-linking monomer		100	300-500 at 25° C.	Neutral	Ketones, esters, chlorinated solvents	No catalyst 77° F. Refrigerated With catalyst 77° F. Refrigerated	3 mo. 1 yr. 24 hr. 7 days	Used as received
	Vibrin X-1306A	Unsaturated polyester with cross-linking monomer		100	500-700 at 25° C.	Neutral	Ketones, esters, chlorinated solvents	No catalyst 77° F. Refrigerated With catalyst 77° F. Refrigerated	6 mo. Indefinitely 2 days 9 days	Used as received
	Vibrin X-1307	Unsaturated polyester with cross-linking monomer		100	Paste at 25° C.	Neutral	Ketones, esters, chlorinated solvents	No catalyst 77° F. Refrigerated With catalyst 77° F. Refrigerated	Indefinitely Indefinitely 4 wks. 3-6 mo.	Used as received
	Vibrin 140	Unsaturated polyester with cross-linking monomer		100	7,000-10,000 at 25° C.	Neutral	Ketones, esters, chlorinated solvents	No catalyst 77° F. Refrigerated With catalyst 77° F. Refrigerated	Indefinitely Indefinitely 7 days 1 mo.	Used as received

Manufacturer	Resin: Company number	Resin: Identity	Treater operations: Impregnation: Apparatus	Impregnation: Preparation of resin	Impregnation: Volatile content	Impregnation: Flow	Drying: Apparatus	Drying: Optimum oven temp.	Drying: Time	Storage: Temp.	Storage: Life
HERCULES POWDER CO., INC. WILMINGTON, DELAWARE		Cellulose acetate	Dip tank Knife coating Brush Spray Spreading Hot melt Radiant heat coating for 100% resin	Dissolve resin	Under ½		Oven	176	12 hr. Adjust by any means until volatile is reached		Stable indefinitely
		Ethyl cellulose	Dip tank Knife coating Brush Spray Spreading Hot melt Radiant heat coating for 100% resin	Dissolve resin	Under ½		Oven	176	12 hr. Adjust by any means until volatile is reached		Stable indefinitely
MONSANTO CHEMICAL CO., PLASTICS DIV. SPRINGFIELD, 2, MASS.	Thalid X-626	Polyester	Dip tank Squeeze roll Roller coating Brush Knife coating	Catalyst is wet with styrene monomer and dissolved in resin. Paste catalysts may be added directly	Some volatile which is completely reactive					Room	Same as pot life
	Thalid X-526-10	Polyester	Dip tank Squeeze roll Roller coating Brush Knife coating	Catalyst is wet with styrene monomer and dissolved in resin. Paste catalysts may be added directly	Some volatile which is completely reactive					Room	Same as pot life
	Thalid X-536	Polyester	Dip tank Squeeze roll Roller coating Brush Knife coating	Catalyst is wet with styrene monomer and dissolved in resin. Paste catalysts may be added directly	Some volatile which is completely reactive					Room	Same as pot life
	Thalid X-641-10	Polyester	Dip tank Squeeze roll Roller coating Brush Knife coating	Catalyst is wet with styrene monomer and dissolved in resin. Paste catalysts may be added directly	Some volatile which is completely reactive					Room	Same as pot life
	Thalid X-651-10	Polyester	Dip tank Squeeze roll Roller coating Brush Knife coating	Catalyst is wet with styrene monomer and dissolved in resin. Paste catalysts may be added directly	Some volatile which is completely reactive					Room	Same as pot life
PITTSBURGH PLATE GLASS CO., COLUMBIA CHEMICAL DIV. FIFTH AVE., AT BELLEFIELD, PITTSBURGH 13, PA.	Allyl diglycol carbonate (Allymer CR-39)	Allyl resin	Dip tank Squeeze roll Brush coating	Heat monomer to 50° C. Add catalyst, stir until completely dissolved, continue stirring while cooling to room temperature			Store impregnated rolls			Room	Same as pot life
PITTSBURGH PLATE GLASS CO., PAINT DIV. MILWAUKEE, WIS.	Selectron 5000 Series	Addition-type copolymer	Spreading Knife coating Roller coating Dip tank Spray Brush	Stir in catalyst. With higher viscosity resins use a paste catalyst	Some volatile which is completely reactive		Store impregnated rolls			Room	14 hr. to 3 days depending on pot life of resin
	Selectron 5200 Series	Addition-type copolymer	Spreading Knife coating Roller coating Dip tank Spray Brush	Stir in catalyst. With higher viscosity resin use a paste catalyst	Some volatile which is completely reactive		Store impregnated rolls			Room	14 hr. to 3 days depending on pot life
	Selectron 5400 Series	Addition-type copolymer	Spreading Knife coating Roller coating Dip tank Brush	Add catalyst to melted paste	Some volatile which is completely reactive		Store impregnated rolls			Room	Up to 6 mo.
PLASKON DIV., LIBBEY-OWENS-FORD GLASS CO. 2112-24 SYLVAN AVE., TOLEDO 6, OHIO	Plaskon 911	Copolymer based on unsaturated polyester	Knife coating Roller or transfer coating in special cases	Dissolve 4 parts paste catalyst in 100 parts resin						Room 40° F.	2-3 days 2 wk.
	Plaskon 930	Copolymer based on unsaturated polyester	Knife coating Roller or transfer coating in special cases	Dissolve 4 parts paste catalyst in 100 parts resin						Room 40° F.	2-3 days 2 wk.
	Plaskon 960	Copolymer based on unsaturated polyester	Knife coating Roller or transfer coating in special cases	Dissolve 4 parts paste catalyst in 100 parts resin						Room 40° F.	2-3 days 2 wk.
REICHHOLD CHEMICALS, INC. 801 WOODWARD HEIGHTS BLVD., DETROIT 20, MICH.	Plyophen 5013	Straight phenolic resin	Dip tank with or without squeeze rolls. Spray	Resin solution used as received	5-5	8-10	Drying tunnel	275	3-5 min.	Room	4-6 mo.
	Paraplex P-10	Polyester resin	Dip tank Squeeze rolls Brush Spreading	Dissolve catalyst in P-10. Gentle warming (120° F.) will dissolve benzoyl peroxide more rapidly	Some, but all volatile is polymerizable	High before gelation begins				Room	4-6 days
RESINOUS PRODUCTS AND CHEMICAL CO., INC. WASHINGTON SQUARE, PHILADELPHIA 5, PA.	Paraplex P-13	Polyester resin	Dip tank Squeeze rolls Brush Spreading	Dissolve catalyst in resin, or in case of benzoyl peroxide predissolve catalyst in styrene and then add to resin	Some, but all volatile is polymerizable	High before gelation begins				Room	4-7 days
	Paraplex AP-43	Polyester resin	Dip tank Squeeze rolls Brush Spreading	Dissolve catalyst in resin, or in case of benzoyl peroxide predissolve catalyst in styrene and then add to resin	Some, but all volatile is polymerizable	High before gelation begins				Room	14 days
U. S. RUBBER CO. NAUGATUCK CHEMICAL DIV. 1230 AVENUE OF THE AMERICAS, NEW YORK 20, N. Y.	Vibrin 103	Unsaturated polyester with cross-linking monomer	Dip tank Roller coating Knife coating Brush	Disintegrate catalyst in equal weight of styrene. Stir paste into resin	May lose styrene					Same as pot life	
	Vibrin X-1306A	Unsaturated polyester with cross-linking monomer	Dip tank Roller coating Knife coating Brush	Disintegrate catalyst in equal weight of catalyst solvent supplied. Stir paste into resin	Negligible					Same as pot life	
	Vibrin X-1307	Unsaturated polyester with cross-linking monomer	Dip tank Roller coating Knife coating Brush	Prepare paste as for X-1306A. Stir into molten resin at 50-60° C.	Negligible					Same as pot life	
	Vibrin 140	Unsaturated polyester with cross-linking monomer	Dip tank Roller coating Knife coating Brush	Disintegrate catalyst in equal weight of styrene. Stir paste into resin	May lose styrene					Same as pot life	

Manufacturer	Resin: Company number	Resin: Identity	Curing operations: Equipment: Presses	Equipment: Molds	Equipment: Ovens	Curing cycle: Mold release agent	Curing cycle: Optimum pressure	Curing cycle: Optimum temp.	Curing cycle: Thickness	Curing cycle: Time	Heat distortion point: Cast resin temp.	Heat distortion point: Laminate temp.
HERCULES POWDER CO., INC. WILMINGTON, DELAWARE		Cellulose acetate	Standard equipment. Platen type usual	Standard equipment	Standard equip.	Laminates free themselves from cold surface. Can use stearates	100				130 to 140 for hard formulation	
		Ethyl cellulose	Standard equipment. Platen type usual	Standard equipment	Standard equip.	Laminates free themselves from cold surface. Can use stearates	100				100 to 120 for hard formulation	
MONSANTO CHEMICAL CO., PLASTICS DIV. SPRINGFIELD, 2, MASS.	Thalid X-626	Polyester	Standard equipment	Standard equipment	All conventional types	Cellophane, PVA, Ortholeum 162, Vejin A3C, Dow Corning Fluid #200	Contact to 400	220 at center of laminate		5 to 15 min.	155	Over 312
	Thalid X-526-10	Polyester	Standard equipment	Standard equipment	All conventional types	Cellophane, PVA, Ortholeum 162, Vejin A3C, Dow Corning Fluid #200	Contact	220		5 to 15 min.		
	Thalid X-536	Polyester	Standard equipment	Standard equipment	All conventional types	Cellophane, PVA, Ortholeum 162, Vejin A3C, Dow Corning Fluid #200	Contact to 400	220		5 to 15 min.		
	Thalid X-641-10	Polyester	Standard equipment	Standard equipment	All conventional types	Cellophane, PVA, Ortholeum 162, Vejin A3C, Dow Corning Fluid #200	Contact	220		5 to 15 min.	135	
	Thalid X-651-10	Polyester	Standard equipment	Standard equipment	All conventional types	Cellophane, PVA, Ortholeum 162, Vejin A3C, Dow Corning Fluid #200	Contact	220		10 to 15 min.		
PITTSBURGH PLATE GLASS CO., COLUMBIA CHEMICAL DIV. FIFTH AVE., AT BELLEFIELD, PITTSBURGH 13, PA.	Allyl diglycol carbonate (Allymer CR-39)	Allyl resin		Glass, iron, aluminum, metal alloy, plaster, wood, cellophane, PVA	Heated air forced draft	Cellophane, wax, PVA	1-5	Start at 158 Raise slowly to 338	⅛ ... 4-6 hr. ½ ... 6-8 hr.	6-30 min. depending on pot life. Half of value above	10 mils 140-167	> 206
PITTSBURGH PLATE GLASS CO., PAINT DIV. MILWAUKEE, WIS.	Selectron 5000 Series	Addition-type copolymer	Standard equipment	Standard equipment	Standard equipment	Carnauba wax, PVA (sheet or coating), cellophane, Vejin, carboxymethyl-cellulose	Contact 10 ... 275	200 to 250		6-30 min. depending on pot life. Half of value above	176 See Note 1	
	Selectron 5200 Series	Addition-type copolymer	Standard equipment	Standard equipment	Standard equipment	Carnauba wax, PVA (sheet or coating), cellophane, Vejin, carboxymethyl-cellulose	Contact 10 ... 275	200 to 250		6-30 min. depending on pot life. Half of value above	See Note 1	
	Selectron 5400 Series	Addition-type copolymer	Standard equipment	Standard equipment	Standard equipment	Carnauba wax, PVA (sheet or coating), cellophane, Vejin, carboxymethyl-cellulose	Contact	200 to 250		6-30 min. depending on pot life	230 See Note 1	
PLASKON DIV., LIBBEY-OWENS-FORD GLASS CO. 2112-24 SYLVAN AVE., TOLEDO 6, OHIO	Plaskon 911	Copolymer based on unsaturated polyester	All standard types	Standard equipment	All standard types	PVA sheet Cellophane, 1% solution of Vejin A3 (centrifuged in benzene) Methyl or ethyl cellulose	Contact	212 ... ½ ... 250 ... ¼ ... 300 ... ⅛ ...		30 min. 8 min. 1-2 min.		
	Plaskon 930	Copolymer based on unsaturated polyester	All standard types	Standard equipment	All standard types	PVA sheet Cellophane, 1% solution of Vejin A3 (centrifuged in benzene) Methyl or ethyl cellulose	Contact	212 ... ½ ... 250 ... ½ ... 300 ... ½ ...		30 min. 8 min. 1-2 min.		
	Plaskon 960	Copolymer based on unsaturated polyester	All standard types	Standard equipment	All standard types	PVA sheet Cellophane, 1% solution of Vejin A3 (centrifuged in benzene) Methyl or ethyl cellulose	Contact	212 ... ½ ... 250 ... ½ ... 300 ... ½ ...		30 min. 8 min. 1-2 min.		
REICHHOLD CHEMICALS, INC. 801 WOODWARD HEIGHTS BLVD., DETROIT 20, MICH.	Plyophen 5013	Straight phenolic resin	Platen press. hat press	Bag molding. Any type of mold		Cellophane, stearic acid	50 250	Without hardener and at 325 With hardener and at 320	⅛ ... ½ ... ⅛ ... ½ ...	10-12 min. 45 min. 5-7 min. 35 min.		
	Paraplex P-10	Polyester resin	All standard types	All conventional types		Cellophane, stearic acid, PVA, Polyplastex #595, Vejin	Contact to 50	270	⅛	20 min.	No significance. Flexible resin	
RESINOUS PRODUCTS AND CHEMICAL CO., INC. WASHINGTON SQUARE, PHILADELPHIA 5, PA.	Paraplex P-13	Polyester resin	Platen, hot press or other conventional types	Glass, iron, aluminum, plaster, wood, PVA, cellophane or bag	All standard types	Cellophane, PVA, Polyplastex #595, Vejin	Contact to 100	200	⅛	15 min.		
	Paraplex AP-43	Polyester resin	Platen, hat press or other conventional types	Glass iron, aluminum, plaster, wood, PVA, cellophane or bag	All conventional types	Cellophane, PVA, Polyplastex #595, Dow Corning #7, Vejin	Contact to 1,000	260	⅛	10 min.		
U. S. RUBBER CO. NAUGATUCK CHEMICAL DIV. 1230 AVENUE OF THE AMERICAS, NEW YORK 20, N. Y.	Vibrin 103	Unsaturated polyester with cross-linking monomer	All conventional types	Wood, plaster, metal, concrete	Any conventional type	Cellophane, PVA sheet, cellulose acetate, silicones, carboxymethyl-cellulose, ceresin wax, carnauba wax	Contact to 15	200 to 250		5 min. or more to suit conditions		
	Vibrin X-1306A	Unsaturated polyester with cross-linking monomer	All conventional types	Wood, plaster, metal, concrete	Any conventional type	Cellophane, PVA sheet, cellulose acetate, silicones, carboxymethyl-cellulose, ceresin wax, carnauba wax	Contact to 15	200 to 250		5 min. or more to suit conditions		
	Vibrin X-1307	Unsaturated polyester with cross-linking monomer	All conventional types	Wood, plaster, metal, concrete	Any conventional type	Cellophane, PVA sheet, cellulose acetate, silicones, carboxymethyl-cellulose, ceresin wax, carnauba wax	Contact to 15	200 to 250		5 min. or more to suit conditions		
	Vibrin 140	Unsaturated polyester with cross-linking monomer	All conventional types	Wood, plaster, metal, concrete	Any conventional type	Cellophane, PVA sheet, cellulose acetate, silicones, carboxymethyl-cellulose, ceresin wax, carnauba wax	Contact to 15	200 to 250		5 min. or more to suit conditions		

Manufacturer	Resin: Company number	Resin: Identity	Electrical properties of cast resin: Freq. 60 cycles: Power factor	Freq. 60 cycles: Dielectric constant	Freq. 60 cycles: Loss factor	Freq. 10⁶ cycles: Power factor	Freq. 10⁶ cycles: Dielectric constant	Freq. 10⁶ cycles: Loss factor	Freq. 10⁸ cycles: Power factor	Freq. 10⁸ cycles: Dielectric constant	Freq. 10⁸ cycles: Loss factor	Dielectric strength: Short time	Dielectric strength: Step-by-step	Arc resistance	End application	General notes
			%										v./mil	sec.		
HERCULES POWDER CO., INC. WILMINGTON, DELAWARE		Cellulose acetate	Soft Dry .007 Wet .83 Medium Dry .054 Wet .21 Hard Dry .023 Wet .14	Soft Dry 6.8 Wet 15.1 Medium Dry 5.3 Wet 8.6 Hard Dry 5.0 Wet 7.0		Soft Dry .043 Wet .022 Medium Dry .069 Wet .059 Hard Dry .051 Wet .043	Soft Dry 5.4 Wet 7.5 Medium Dry 4.4 Wet 6.6 Hard Dry 4.2 Wet 6.4					Soft Dry 300 Wet 350 Medium Dry 300 Wet 500 Hard Dry 350 Wet 350 See Note 1		Luggage, automotive applications, industrial housings, switch boxes, carpet sweepers	No shrinkage of resin. Flat sheets are usually made and then postformed at 310-325° F. Extensive color possibilities. Note 1. Specimen approximately 0.10 in. thick.
		Ethyl cellulose	Soft Dry .0064 Wet .013 Medium Dry .009 Wet .02 Hard Dry .009 Wet .02	Soft Dry 2.9 Wet 4.1 Medium Dry 3.3 Wet 4.6		Soft Dry .037 Wet .029 Medium Dry .013 Wet .017 Hard Dry .012 Wet .02	Soft Dry 4.2 Wet 5.0 Medium Dry 3.3 Wet 4.3 Hard Dry 3.3 Wet 4.8					Soft Dry 500 Wet 450 Medium Dry 550 Wet 500 Hard Dry 550 Wet 500 See Note 1		Luggage, automotive applications, industrial housings, switch boxes, carpet sweepers	No shrinkage of resin. Flat sheets are usually made and then postformed at 310-325° F. Ethyl cellulose should be heat stabilized using monthyl phenol. Marketed as stabilizer K by Hercules. Extensive color possibilities. Note 1. Specimen approximately 0.10 in. thick.
MONSANTO CHEMICAL CO., PLASTICS DIV. SPRINGFIELD, 2, MASS.	Thalid X-626	Polyester				0.0132	3.64	0.052	0.0271	3.26	0.0915			70	Molded parts	
	Thalid X-526-10	Polyester													Flat laminates, table tops	
	Thalid X-536	Polyester													Bag molded parts	
	Thalid X-641-10	Polyester							0.0145	2.81	0.0416			15	Flat laminates, self-extinguishing wing liner board where flameproof properties are desired	
	Thalid X-651-10	Polyester													Flat laminates with greater flexibility than with full rigid resins	
PITTSBURGH PLATE GLASS CO., COLUMBIA CHEMICAL DIV. FIFTH AVE., AT BELLEFIELD, PITTSBURGH 13, PA.	Allyl diglycol carbonate (Allymer CR-39)	Allyl resin							See Note 2			See Note 3			Aircraft parts	Note 1. Samples ¼ in. thick. Note 2. Samples ½ in. thick. Note 3. Test at 25.5° C.; relative humidity 50%. Note 4. Diam of test electrode, 2.00 inches. Shrinkage in curing, 13%. Slight yellow cast. Excellent solvent resistance.
PITTSBURGH PLATE GLASS CO., PAINT DIV. MILWAUKEE, WIS.	Selectron 5000 Series	Addition-type copolymer							See Note 2			See Note 3			Aircraft laminates, electrical appliances, cast sheets, rods and tubing, jewelry embedments, fiber impregnated cabinets and housings, molded and contiguous laminates	Specialty type available Water white resins Flameproof resins High impact resins for special casting applications Resins for high temperature application Opaque and transparent Selectron 6500 color concentrates are available. Note 1. Contact Pittsburgh Plate Glass Co. for specific information on exact laminates desired. Note 2. For full information on electrical properties, contact Pittsburgh Plate Glass Co.
	Selectron 5200 Series	Addition-type copolymer							See Note 2			See Note 3			Flexible laminates, cast flexible sheets, rods and tubing, molded flexible parts, non-rigid impregnated fabric	Special air-curing types available Opaque and transparent Selectron 6500 color concentrates are available. Note 1. Contact Pittsburgh Plate Glass Co. for specific information on exact laminates desired. Note 2. For full information on electrical properties, contact Pittsburgh Plate Glass Co.
	Selectron 5400 Series	Addition-type copolymer							See Note 2			See Note 3			Aircraft applications, electrical appliances, housing and parts, structural applications	Pigment concentrates and dyes are available. Resin is a paste (not fluid at room temperature). Note 1. Contact Pittsburgh Plate Glass Co. for specific information on exact laminates desired. Note 2. For full information on electrical properties contact Pittsburgh Plate Glass Co. Note 3. Selectron 5700 Series resins for use as adhesives are available.
PLASKON DIV., LIBBEY-OWENS-FORD GLASS CO. 2112-24 SYLVAN AVE., TOLEDO 6, OHIO	Plaskon 911	Copolymer based on unsaturated polyester							0.025	3.4	0.086				Ducts, radar housing, aircraft parts, cabinets, furniture, table tops, wall coverings, laminated shades, fishing rods	Resin has a light amber color, doesn't darken with age Resin comes in two parts, liquid resin and catalyst paste.
	Plaskon 930	Copolymer based on unsaturated polyester							0.045	3.9	0.176				Ducts, radar housing, aircraft parts, cabinets, furniture, table tops, wall coverings, laminated shades, fishing rods	Resin has a light amber color, doesn't darken with age Resin comes in two parts, liquid resin and catalyst paste.
	Plaskon 960	Copolymer based on unsaturated polyester							0.072	4.5	0.325				Ducts, radar housing, aircraft parts, cabinets, furniture, table tops, wall coverings, laminated shades, fishing rods	Resin has a light amber color, doesn't darken with age Resin comes in two parts, liquid resin and catalyst paste.
REICHHOLD CHEMICALS, INC. 801 WOODWARD HEIGHTS BLVD., DETROIT 20, MICH.	Plyophen 5013	Straight phenolic resin													High mechanical strength and high temperature resistant laminates	Resin comes as a natural and also as a black varnish. Addition of ¾-1½% by weight of sodium hydroxide to resin solution gives a faster cure.
	Paraplex P-10	Polyester resin				0.019	4.5	0.085	0.018	4.3	0.077	0.050	3.9	0.195	385	490	110	Electric insulation, decorative applications, luggage, dielectric materials, lampshades	Shrinkage on cure, 8%. Resin has a yellow cast. Polymerized P-10 is flexible but thermoset. Add to other low pressure resins of rigid type to improve impact strength of laminates. The liquid monomers are somewhat inflammable.
RESINOUS PRODUCTS AND CHEMICAL CO., INC. WASHINGTON SQUARE, PHILADELPHIA 5, PA.	Paraplex P-13	Polyester resin				0.015	4.4	0.066	0.009	4.5	0.04	0.052	4.1	0.31	345		133	Wall coverings, lamp shade materials, plotting compounds, place mats	Shrinkage on cure 7.5%. Resin is clear and is a thermoset sinta is flexible and tough.
	Paraplex AP-43	Polyester resin				0.008	3.3	0.026	0.0027	3.2	0.0065	0.017	3.3	0.055	500		124	Aircraft parts, electrical appliances, and paneling, structural applications, table top materials luggage, decorative panels, bag molded assemblies	Shrinkage on cure 7%. High in flexural strength, water resistance, abrasion resistance and toughness.
U. S. RUBBER CO. NAUGATUCK CHEMICAL DIV. 1230 AVENUE OF THE AMERICAS, NEW YORK 20, N. Y.	Vibrin 103	Unsaturated polyester with cross-linking monomer													General decorative and functional laminates of paper, glass, fabrics, etc.	General purpose resin Slight straw color
	Vibrin X-1306A	Unsaturated polyester with cross-linking monomer													General decorative and functional laminates of paper, glass, fabrics, etc.	High hardness. Non-bleeding to most fabric dyes and paper inks. Slight straw color
	Vibrin X-1307	Unsaturated polyester with cross-linking monomer													Waxy nature of uncured resin aids in complex layups	High hardness. Non-fading to most fabric dyes or paper inks
	Vibrin 140	Unsaturated polyester with cross-linking monomer													General decorative and functional laminates	Self extinguishing Slight amber color

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(See also Laminating Chart—10-a)

Q.679.
M721
1947:3
C.2

Q.679
M72i
1947:3
C.2

Q.611
M72i
1947:3
C. 2